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Agrium - Nu-West Industries

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U.S. EPA REGION 10  
OFFICE OF COMPLIANCE AND ENFORCEMENT

January 25, 2012

Mr. James Cagle  
Nu-West Industries  
Conda Phosphate Operations  
3010 Conda Road  
Soda Springs, ID 83276

Re: Video Log and Flow Meter Testing of Mountain Fuel Well  
Administrative Order on Consent for Nu-West CPO Facility  
Docket No. RCRA-10-2009-0186

Dear Mr. Cagle:

Pursuant to the Administrative Order on Consent executed June 23, 2009 by Nu-West Industries and U.S. EPA (Consent Order) and the Work Plan for Additional Requirements dated July 11, 2011 (Additional Work Plan) prepared pursuant to Section VII of the Consent Order, WSP Environment and Energy, LLC (WSP) has prepared this letter to report the results of video log and flow meter testing conducted on the Mountain Fuel well at the Nu-West Conda Phosphate Operations (CPO) facility in Soda Springs, Idaho. The Mountain Fuel well is a production well that has been used historically to provide water to the onsite processing activities and is currently maintained as a backup water supply well. The location of the Mountain Fuel well is shown on Figure 1. A description of well construction details is provided below.

In October 2011 WSP conducted testing of the Mountain Fuel well consisting of a video log followed by flow meter testing under ambient and stressed conditions. WSP conducted this work in conformance with the scope of work described in the Additional Work Plan. Testing was performed by Colog, Inc. (Colog) under the direction of WSP. This letter summarizes observations at the Mountain Fuel Well, followed by proposal for next steps.

#### WELL CONSTRUCTION DETAILS

The Mountain Fuel well was constructed in 1967. The Report of Well Drillers from 1967 (Well Completion Report) describing well construction details is included as Enclosure A, and summarized here. Based on the Well Completion Report, a 24-inch borehole was drilled to 250 feet below ground surface (bgs). The well was constructed using 20-inch diameter steel casing from surface to 171 feet bgs and 16-inch diameter steel casing from 166 feet to 250 feet bgs. The Well Completion Report indicates that a gravel pack was not installed between the borehole and casing during well construction. The well casing was perforated vertically to create openings measuring 0.375-inches wide by 2.5-inches long at three intervals along the casing: 50 to 60 feet bgs, 68 to 165 feet bgs, and 170 to 225 feet bgs.

The Well Completion Report indicates that a yield test was conducted using a 10-inch diameter, 60-inch long 275-horsepower diesel pump. The pump test was conducted for 16.5 hours with the pump operating at 3,405 gpm. The observed drawdown was 3.5 feet.



## **MOUNTAIN FUEL WELL TESTING RESULTS**

Prior to testing, Nu-West contracted SEC Electric to remove the pumping equipment from the well. The testing was conducted on October 19 and 21. Results of the testing are provided in Colog's report, included as Enclosure B. A summary of results is provided below.

### Video Log

The video log provided continuous coverage of the steel casing from 12 to 232 feet bgs. The video camera was operated with a centralizer in order to maintain consistent placement. Suspended and settling solids, which may be indicative of metal scale or bacterial film dislodged from the sidewalls of the well by the centralizer, were observed in the water column.

The video log indicated a depth to water of approximately 22 feet bgs and a perforated interval consisting of vertical cuts starting at a depth of 40 feet bgs, as opposed to 50 feet bgs as described in the Well Completion Report. The entire length of the perforated interval could not be discerned in the video log due to biofouling and scaling. The transition to 16-inch diameter casing was observed at 172 feet bgs, which generally matches the information in the Well Completion Report. The video is included in a disk as part of Enclosure B.

### Flow Meter Testing

Flow meter testing of the well was conducted on October 21, 2011 under both ambient and stressed (pumping) conditions using a Quantum Engineering Corporation Electromagnetic Borehole Flowmeter (EMF). The calibration range of the EMF is 0.01 to 10 gpm. The EMF may be operated using a flow diverter, which consists of fins that direct water into the EMF inner radius where flow rate is measured. For the Mountain Fuel well testing, the EMF was operated without a flow diverter as recommended by the manufacturer, who indicated that the tool is not heavy enough to displace water in such a large borehole while using a diverter. Prior to flow meter testing, the ambient water level was measured at 21.92 feet bgs. Flow measurements were collected at 10-foot increments from 24 to 230 feet bgs. Results of the ambient and stressed flow meter tests are shown on Figure 2 and described below.

During the ambient flow meter test, upward flow between 25 and 90 feet bgs was measured at a rate of 0.01 to 0.09 gpm. Below 100 feet, upward and downward flow rates up to 0.02 gpm were measured, near the calibration range of the EMF.

To conduct the stressed flow meter test, two Grundfos 30SQ/SQE10C-130 submersible pumps were set at the top of the water column. The combined pumping rate of the pumps was 46 gpm. Flow meter measurements during stressed testing were collected starting at the bottom of the well (230 feet bgs) moving upward at 10-foot intervals. Upon completing the flow meter measurements at 110 feet bgs, the generator for one of the two pumps became inoperative. With one pump operating at a flow rate of 21 gpm, the flow meter was subsequently positioned at 24, 30, and 40 feet bgs and measured downward flow of 0.13 gpm.

During the stressed flow meter test, downward flow was measured ranging from 0.04 to 0.13 gpm (Figure 2). These results indicate that stress testing reversed the upward flow observed in the shallow portion of the well (between 25 and 110 feet bgs) during the ambient test, and enhanced downward flow below this depth interval. The downward flow measured

January 25, 2012

during the stressed test suggests that annular space between the well casing and borehole may act as a preferential pathway of flow.

## **SUMMARY**

In summary, the flow meter testing results did not provide evidence of any significant zones of inflow or outflow in the Mountain Fuel well. The construction of the casing and annulus preclude any ability to isolate discrete intervals for sampling. Even with the deployment of straddle packers within the well casing, pumping will draw water through the annular space of the well from outside the interval intended to be isolated. As a result, discrete interval sampling of the Mountain Fuel Well will not produce meaningful results. Based on the above findings, WSP recommends that discrete interval groundwater sampling not be conducted in the Mountain Fuel well.

If you have any questions, please do not hesitate to contact me.

Sincerely,



Amy Hui  
Project Manager

cc: P. Scott Burton, Tim Carlstedt, and Bill Taggart (Hunton & Williams, LLP)

Enclosures



NU-WEST CPO FACILITY  
SODA SPRINGS, IDAHO

## GROUNDWATER MONITORING LOCATIONS

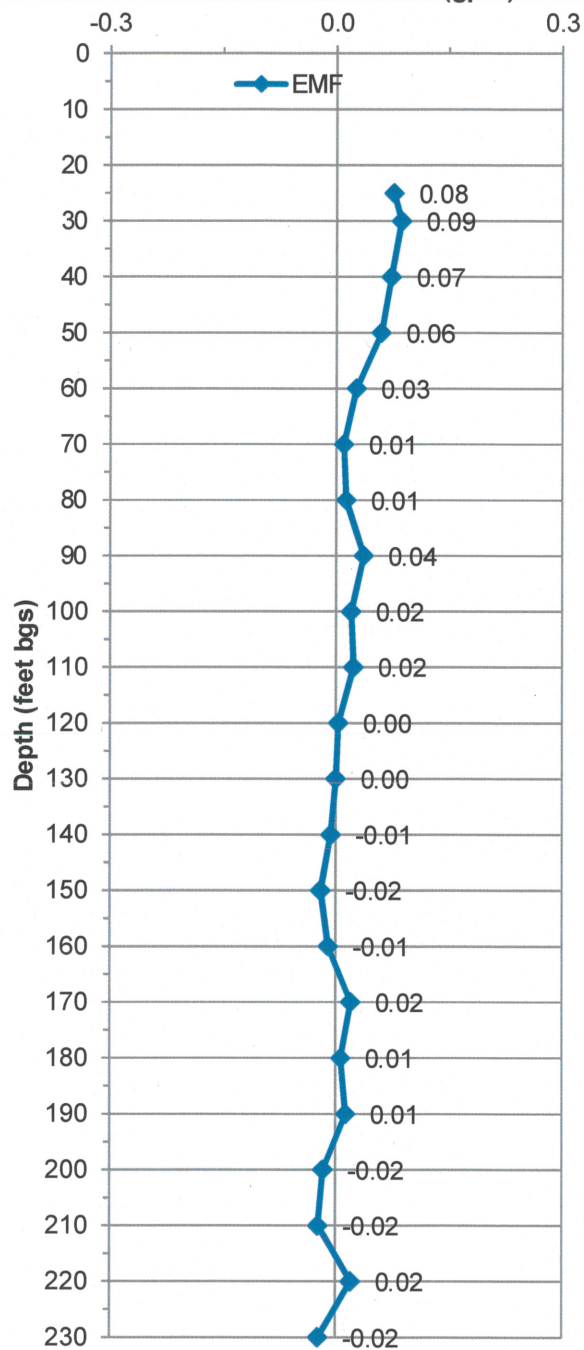
DATE	REVISIONS	DESCRIPTION
REV		
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CHECKED	CHECKED	CHECKED
EGG	EGG	EGG
DRAWN BY	DRAWN BY	DRAWN BY

NOTICE: THIS DRAWING HAS BEEN PREPARED UNDER THE  
 ADOPTION OF STATE LAW FOR ANY PERIODS, UNLESS ACTING  
 ENGINEER, TO ALTER THIS DOCUMENT IN ANY WAY.



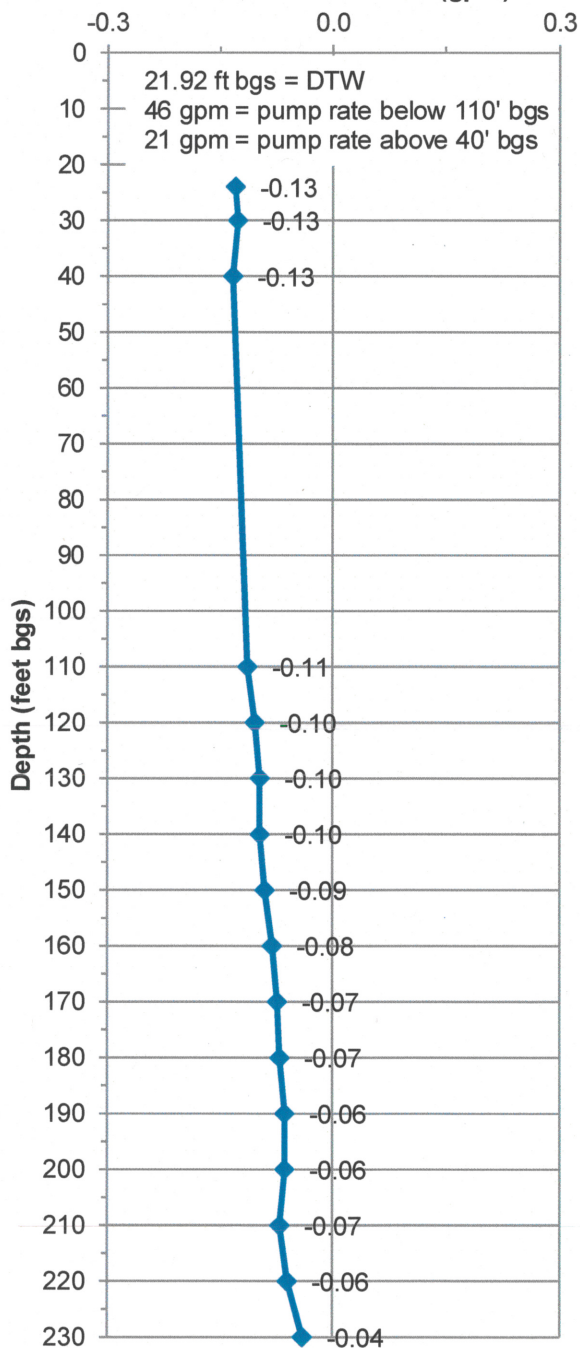
### Ambient Flowmeter Results

Vertical Borehole Flow (gpm)



### Stressed Flowmeter Results

Vertical Borehole Flow (gpm)



4600 South Ulster Street, Suite 930  
Denver, Colorado 80237  
303-850-9200

Figure 2

Summary of Flow Meter Testing Results - Mountain Fuel Well  
Nu-West Industries, Inc.  
Conda Phosphate Operations  
Soda Springs, Idaho

**REPORT OF WELL DRILLER**  
State of Idaho

**RECEIVED**  
JUL 5 1967

State law requires that this report shall be filed with the State Reclamation Engineer within 30 days after completion or abandonment of the well.

**WELL OWNER:**

Name Mountain Fuel Supply Company

Address P. O. Box 795, Soda Springs, Idaho

Owner's Permit No. G33574 App. 41828

NATURE OF WORK (check): Replacement well ☐  
New well ☒ Deepened ☐ Abandoned ☐

Water is to be used for: Industrial

METHOD OF CONSTRUCTION: Rotary ☐ Cable ☒  
Dug ☐ Other ☐

(explain)

CASING SCHEDULE: Threaded ☐ Welded ☐

20" Diam. from 0 ft. to 171 ft.

16" Diam. from 166 ft. to 250 ft.

" Diam. from  ft. to  ft.

" Diam. from  ft. to  ft.

Thickness of casing: 5/16 Material:

Steel ☒ concrete ☐ wood ☐ other ☐

(explain)

PERFORATED? Yes ☒ No ☐ Type of perforator used: Torch and grinding

Size of perforations: 3/8 " by 2 1/2 "

20 perforations from 50 ft. to 60 ft.

20 perforations from 68 ft. to 165 ft.

16 perforations from 170 ft. to 225 ft.

perforations from  ft. to  ft.

WAS SCREEN INSTALLED? Yes ☐ No ☒

Manufacturer's name

Type  Model No.

Diam.  Slot size  Set from  ft. to  ft.

Diam.  Slot size  Set from  ft. to  ft.

CONSTRUCTION: Well gravel packed? Yes ☐

No. ☒ size of gravel  Gravel

placed from  ft. to  ft. Surface seal

provided? Yes ☒ No ☐ To what depth?

15 ft. Material used in seal: Cement Grout

Did any strata contain unusable water? Yes ☐

No. ☒ Type of water:

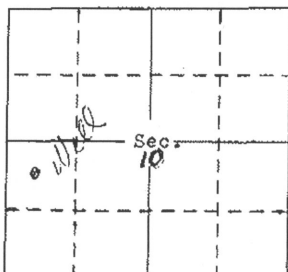
Depth of strata  ft. Method of sealing

strata off:

Surface casing used? Yes ☒ No ☐

Cemented in place? Yes ☒ No ☐

Locate well in section



LOCATION OF WELL: County Caribou

SW X NW X Sec. 10 T. 8 N/S R. 42 E/W

Use other side for additional remarks.

Size of drilled hole: 24-inch Total

depth of well: 250-feet Standing water

level below ground: 33 Temp. 43 1/2

Fahr. 43 1/2 ° Test delivery: 3405 gpm

or  cfs Pump? ☐ Bail ☐

Size of pump and motor used to make test:

10" X 60' -- 275 H. P. Diesel

Length of time of test: 16 Hrs. 30 Min.

Drawdown: 3 1/2 ft. Artesian pressure: ft.

above land surface  Give flow  cfs

or  gpm. Shutoff pressure:

Controlled by: Valve ☐ Cap ☐ Plug ☐

No control ☐ Does well leak around casing?

Yes ☐ No ☒

DEPTH 29396 MATERIAL 29396 WATER

FROM TO YES OR NO

FEET FEET

0 2 Topsoil

2 5 Light Clay

5 12 Hard Lava

12 24 Red Lava

24 40 Hard Lava

40 49 Brown Clay

49 58 Soft Lava (Good Water) Yes

58 65 Hard Lava No

65 79 Soft Lava Yes

79 115 Grey Black Lava Yes

115 131 Gray Lava Yes

131 137 Brown Clay No

137 149 Brown Clay & Cinders No

149 174 Soft Lava Yes

174 180 Brown Clay No

180 224 Soft Lava Yes

224 232 Brown Clay No

232 250 Hard Lava Yes

Work started: May 11, 1967

Work finished: June 9, 1967

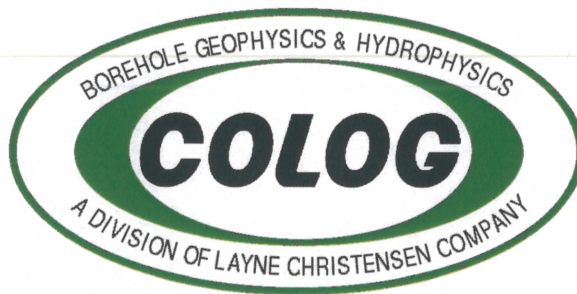
Well Driller's Statement: This well was drilled under my supervision and this report is true to the best of my knowledge.

Name: J. S. Lee & Sons

Address: 4091 South State Street

Signed by: Robert E. Lee

License No. 292 Date: June 28, 1967



**Geophysical Logging Results  
WSP Environment and Energy  
Nu-West Industries – Mountain Fuel Well  
Soda Springs, ID**

Prepared for:  
WSP Environment and Energy  
January 17, 2012

Prepared by:  
COLOG Division of Layne Christensen Company  
810 Quail Street Suite E, Lakewood, CO, 80215  
Phone: (303) 279-0171 Fax: (303) 278-0135



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#### **3.0 Limitations**

Attachment A: Pump Specifications for the 30SQ/SQE10C-130 Submersible Pump

## **1.0 Geophysical Logging Results**

On October 19 and 21, 2011, the Mountain Fuel Well at the Nu-West Agrium site near the town of Soda Springs, Idaho, was inspected with video and geophysically logged for flow evaluation under ambient and low-rate pumping conditions. The inner diameter (ID) of the steel casing at the surface is 19.5" and total depth was reached during logging at 232.1 feet. The subject well is steel cased to TD with slots at various depths. A diameter reduction is observed at 172 feet, though it is unknown to what diameter.

### **1.1 Video Inspection**

A video inspection survey was recorded in the Mountain Fuel Well on October 19, 2011, covering depths of 6 to 232.1 feet. The diameter of the wellbore is observed to be 19.5" ID at the surface. At 172 feet a ledge is observed, primarily while logging on the way up, at 172'. This ledge is likely the result of a diameter change (reduction) at this depth. Additionally, the smaller diameter casing beginning at this depth, is not centralized in the larger diameter casing. This is evidenced by the ledge that is observed on only a portion of the 360-degree rotating side-view at 172 feet. The portion of the wellbore that does not present a ledge in the side-view is the side of the larger wellbore that the smaller casing is leaning against. The side of the wellbore that presents a ledge is the far side of the larger-diameter well casing where the gap between smaller casing and larger casing is greatest. Moreover, as the downhole camera entered the smaller diameter casing, the centralizers collapsed on one side, as they are designed to do in smaller diameters, pushing the camera over to one side of the casing – the side in which the centralizers collapsed – providing further evidence of the diameter reduction at 172 feet. Considerable growth of bio-foul is observed on the ledge at the transition of the larger to smaller diameter casings. Although the camera cannot provide any information as to the diameter of the smaller casing, according to WSP the smaller diameter casing may be 16" in diameter.

Slots in the casing are observed at approximately 40 feet (38.8 feet on the side-view lens) and are continuously observed to a depth of approximately 79 feet. The slots are in good conditions with little to no bio-fouling. Of particular note however, is a hole in the casing observed at 55 feet (53.7 feet on the side-view). Below 79 feet the wellbore water begins to cloud and an increase in bio-foul both on the sides of the wellbore and in suspension in the wellbore fluid is observed. Below 79 feet the clarity of the water prevents direct observation of the slots, if any. A determination can not be made regarding the presence of slots below 79 feet due to the increase in bio-fouling.

At numerous depths below 120 feet, particles suspended in the wellbore fluid are observed to be migrating either down the wellbore or up the wellbore. This observed migration of particles should not be interpreted as vertical flow within the wellbore. The migration of particles is the combined effect of turbulence in the wellbore as the result of movement of the downhole video camera and its bow springs, and heavier particles falling as simply the result of gravity. Where particles are observed to migrate up the wellbore once the camera is moved to a particular depth, with time or a very short change in depth, no particles are observed to migrate up the wellbore but instead, are observed to migrate down. Another short change in depth and the particles are observed to migrate up the wellbore again. This pattern was observed throughout several depths below approximately 120 feet where the bio-fouling was significant.

The video inspection survey encountered fill at the bottom of the wellbore at 232.1 feet. Static water level is observed at 22.0 feet from ground surface.

## 1.2 EM Flow Meter Logging

EM flow meter testing under ambient and pumping conditions was performed in the Mountain Fuel Well on October 21, 2011. No diverters were used in this large-diameter well per the probe manufacturer's recommendations for logging in large-diameter wellbores. The presence of a diverter in a large diameter casing would prevent the relatively light-weight probe from advancing down the wellbore. Moreover, diverters would likely funnel all particulates, or bio-foul, in the wellbore through the flow chamber of the probe where flow is measured, likely clogging the flow chamber of the probe. So the decision was made to forgo logging with a diverter on the EM flow meter. The lack of the diverter, however, theoretically reduces the low-flow resolution of the EM flow meter. As such, a modified procedure for estimating volumetric flow rate from the registered voltage response of the probe was adopted, per the probe's manufacturer. The modified approach is summarized as follows: the volume of water in 1 foot of 19.5" casing is 15.5 gallons. The volume in the 0.90-inch diameter flow chamber of the EM flow meter per 1 foot of length is approximately 0.03 gallons. An observed flow velocity of 0.30 feet per min (fpm) would equate to a volumetric flow rate of 0.01 gpm. Assuming the vertical flow velocity in the wellbore is the same outside of the flow chamber as it is inside the flow chamber, i.e. no effect from the probe or friction from the side of the well casing, then an observed flow rate of 0.01 gpm (flow velocity of 0.30 fpm) from the probe hanging free in the well casing with no diverter equates to a total wellbore flow rate of approximately 4.7 gpm. The key to this correlation is the observed flow rate from the EM flow meter must be repeatable and accurate. The EM flow meter commonly registers 0.01 gpm of flow, either upward or downward, in a near zero-flow environment simply due to the flow measurement being at the lower limit of the probes resolution. Therefore, it is assumed the lower limit of the EM flow meter in this application is approximately 4.7 gpm in the 19.5-inch casing and 3.1 gpm in the 16" casing. The flow rates presented in Tables 1 and 2 are the flow rates registered by the probe downhole through the 1-inch flow chamber in the probe. Again, no diverter was used in the testing of the Mountain Fuel Well.

### 1.2.1 EM Flow Meter Logging – Ambient Test

Results from the EM flow meter testing conducted under ambient conditions (no pumping) are inconsistent and suggest flow, if any, in the wellbore under ambient conditions is below the theoretical detection limit of the probe under these conditions (19.5" wellbore with no diverter) of approximately 4.7 gpm in the 19.5-inch casing. The flow results under ambient conditions registered upflow of less than or equal to 0.09 gpm above 110 feet, but inconsistent results of upflow and downflow of less than or equal to 0.02 gpm below 120 feet. The flow results were also inconsistent with respect to depths in near proximity to each other. With the exception of an extremely complex flow regime, it is expected that results at one test station would be similar to another test station in close proximity to each other, unless a flow direction change is observed and quantified. The inconsistent results of the EM flow meter suggest the flow was either below its detection limit or flow was affected by turbulence from the probe or other source that was clearly observed in the video inspection log. In the video inspection log, particles in suspension were observed to float, and even change directions while the camera was stationary, with no pattern to the movement of particles. The turbulence that was present due to, perhaps, the movement of the camera, that caused this direct observation of particles migrating in all directions, may be the source of the inconsistent readings observed here with the EM flow meter. It is the conclusion of COLOG that the flow in the wellbore under ambient conditions is below the theoretical flow detection limit of the probe under these conditions. Please see Table 1 for a summary of the EM flow meter results under ambient conditions. The depth to water at the time of testing was recorded at 21.92 feet below ground surface.



### 1.2.2 EM Flow Meter Logging – Stress Test

Two downhole pumps were used simultaneously to try to stress the Mountain Fuel Well as much as possible with the equipment available. Please see Attachment A at the end of this report for the manufacturer and pump specifications for the two pumps used on the Mountain Fuel Well. The combined flow rate of the two pumps was approximately 46 gpm. The Mountain Fuel Well is known to be a higher-yielding well than 46 gpm, however, due to costs, a larger pump to properly stress this well was prohibitive. Through communications with WSP and COLOG prior to the commencement of this project, it was decided that EM flow meter testing would be attempted at this lower combined pumping rate to identify, if any, flow entering the wellbore under pumping conditions. No discernable drawdown was measured or observed as a result of pumping at 46 gpm. Ambient water level was recorded at 21.92 feet below ground surface. The pumping water level was recorded at 21.92 feet below ground surface.

The results of the EM flow meter acquired during pumping were again inconsistent, and did not make intuitive sense when compared to the results obtained during ambient testing. The EM flow meter tests during pumping registered all down flow, and at higher flow magnitudes than were observed during ambient testing. Discounting any exterior influences such as nearby pumping, these results cannot be possible. The results are again, likely due to the flow in the wellbore being at or below the detection limit of the probe, causing the probe to be more susceptible to turbulence as was observed in the ambient flow meter testing and the video inspection survey. In fact, the probe registered relatively significant downflow at test stations of 20, 30 and 40 feet – all at or above the slots observed in the downhole video, further suggesting the probe was registering effects in the wellbore that are not associated with groundwater flow. An important point should be made here: the pumps were set at 21 and 23 feet from ground surface, pumping at a combined 46 gpm. The probe should have identified 46 gpm in the wellbore if flow was entering the wellbore from below any test station of the EM flow meter. However, approximately an hour into pumping the generator supplying power to one of the downhole pumps quit and could not be re-started. As such, all test stations above 140 feet were tested while the well was pumped at a rate of 21 gpm. No discernable change was observed in the EM flow meter data nor in the total drawdown after the total pumping rate was reduced to 21 gpm. Due to time constraints, it was decided by WSP to forgo testing above 110 feet until 40 feet. EM flow meter testing was resumed at 40 feet and above. The flow meter still registered downflow above 40 feet. Please refer to Table 2 for a summary of the EM flow meter results under pumping conditions. The depth to water at the time of testing was recorded at 21.92 feet below ground surface.

Due to the inconsistent readings registered by the EM flow meter, a test of the probe and its functionality was conducted in order to negate the probe and its system as a cause for the inconsistent data. The probe was manually trolled both up and down the wellbore at a controlled speed to simulate flow through the flow chamber of the probe. The flow data from the probe was simultaneously monitored. The probe registered flow in the proper flow direction (upflow while trolling in the downward direction and downflow while the probe was trolled in the upward direction) and at the proper magnitude. The probe was deemed to be functioning properly.

Table 1: Summary of EM Flow Meter Logging Results Under Ambient Conditions; WSP Environment and Energy; Nu-West Industries; Soda Springs, ID; Mountain Fuel Well

Mtn Fuel Well - EMF Under Ambient Conditions						
AWL = 21.92' ref to GS, SU=0.00'.						
Depth (ft)	1st	2nd	3rd	EMF Registered GPM	Flow Direction	Estimated GPM in Wellbore <sup>1</sup>
25.00	0.09	0.07	0.07	0.08	upflow	< 4.7
30.00	0.09	0.09	0.08	0.09	upflow	< 4.7
40.00	0.07	0.07	0.08	0.07	upflow	< 4.7
50.00	0.06	0.05	0.07	0.06	upflow	< 4.7
60.00	0.03	0.02	0.03	0.03	upflow	< 4.7
70.00	0.00	0.03	0.00	0.01	upflow	< 4.7
80.00	0.03	0.01	0.00	0.01	upflow	< 4.7
90.00	0.04	0.03	0.04	0.04	upflow	< 4.7
100.00	0.03	0.01	0.02	0.02	upflow	< 4.7
110.00	0.03	0.02	0.02	0.02	upflow	< 4.7
120.00	-0.02	0.01	0.02	0.00	upflow	< 4.7
130.00	0.01	0.00	-0.01	0.00	upflow	< 4.7
140.00	-0.01	-0.01	0.00	-0.01	downflow	< 4.7
150.00	-0.02	-0.02	-0.02	-0.02	downflow	< 4.7
160.00	-0.01	-0.02	0.00	-0.01	downflow	< 4.7
170.00	0.03	0.02	0.01	0.02	upflow	< 4.7
180.00	0.00	0.00	0.02	0.01	upflow	< 3.1
190.00	0.02	0.01	0.01	0.01	upflow	< 3.1
200.00	-0.01	-0.01	-0.03	-0.02	downflow	< 3.1
210.00	0.00	-0.05	-0.02	-0.02	downflow	< 3.1
220.00	0.02	0.01	0.03	0.02	upflow	< 3.1
230.00	-0.02	-0.04	-0.01	-0.02	downflow	< 3.1

No diverter on any of these test stations

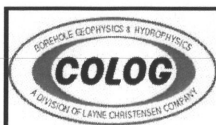
<sup>1</sup> The readings registered by the EMF are erratic, most likely due to the flow in the wellbore being below the probe's detection limit of approximately 4.7 gpm in a 19.5" diameter wellbore and 3.1 gpm in a 16" wellbore (proposed 16" diameter wellbore below 172 feet).

Table 2: Summary of EM Flow Meter Logging Results During Pumping at 46 GPM; WSP Environment and Energy; Nu-West Industries; Soda Springs, ID; Mountain Fuel Well

Mtn Fuel Well - EMF Under Pumping Conditions						
AWL = 21.92' ref to GS, SU=0.00'. Pumps on at 13:37 hr., Oct. 21, 2011. Q = ~46 gpm, no appreciable drawdown						
Depth (ft)	1st	2nd	3rd	EMF Registered GPM	Flow Direction	Estimated GPM in Wellbore <sup>1</sup>
24.00	-0.13	-0.12	-0.14	-0.13	downflow	< 4.7
30.00	-0.10	-0.14	-0.14	-0.13	downflow	< 4.7
40.00	-0.13	-0.13	-0.14	-0.13	downflow	< 4.7
50.00	NA	NA	NA	NA	NA	NA
60.00	NA	NA	NA	NA	NA	NA
70.00	NA	NA	NA	NA	NA	NA
80.00	NA	NA	NA	NA	NA	NA
90.00	NA	NA	NA	NA	NA	NA
100.00	NA	NA	NA	NA	NA	NA
110.00	-0.12	-0.11	-0.11	-0.11	downflow	< 4.7
120.00	-0.12	-0.10	-0.09	-0.10	downflow	< 4.7
130.00	-0.11	-0.09	-0.09	-0.10	downflow	< 4.7
140.00	-0.10	-0.10	-0.09	-0.10	downflow	< 4.7
150.00	-0.09	-0.09	-0.09	-0.09	downflow	< 4.7
160.00	-0.08	-0.07	-0.09	-0.08	downflow	< 4.7
170.00	-0.07	-0.08	-0.07	-0.07	downflow	< 4.7
180.00	-0.08	-0.06	-0.07	-0.07	downflow	< 3.1
190.00	-0.08	-0.06	-0.05	-0.06	downflow	< 3.1
200.00	-0.05	-0.08	-0.06	-0.06	downflow	< 3.1
210.00	-0.07	-0.08	-0.06	-0.07	downflow	< 3.1
220.00	-0.05	-0.06	-0.07	-0.06	downflow	< 3.1
230.00	-0.04	-0.03	-0.05	-0.04	downflow	< 3.1

<sup>1</sup> The readings registered by the EMF are erratic, most likely due to the flow in the wellbore being below the probe's detection limit of approximately 4.7 gpm in a 19.5" diameter wellbore and 3.1 gpm in a 16" wellbore (proposed 16" diameter wellbore below 172 feet).





# EM Flowmeter Log

COMPANY: WSP

PROJECT: Nu-West, Agrium

DATE LOGGED: 21 October 2011

WELL: Mountain Fuel Well

COLOG Main Office

810 Quail Street, Suite E, Lakewood, CO 80215

Phone: (303) 279-0171, Fax: (303) 278-0135

www.colog.com

EM Flow - Ambient		Depth 1ft:310ft	EM Flow - Pumping	
-0.2	gpm		-0.2	gpm
		0		
		10		
		20		
○ 0.080		30		○ -0.130
○ 0.090		40		○ -0.130
○ 0.070		50		○ -0.130
○ 0.060		60		
○ 0.030		70		
○ 0.010		80		
○ 0.010		90		
○ 0.040		100		
○ 0.020		110		
○ 0.020		120		
○ 0.000		130		
○ 0.000		140		
○ -0.010		150		
○ -0.020		160		
○ -0.010		170		
○ 0.020		180		
○ 0.010		190		
○ 0.010		200		
○ -0.020		210		
○ -0.020		220		
○ 0.020		230		
○ -0.020		240		

Pump Rate 21 gpm: 20 - 40 ft  
No Data: 50 - 100 ft  
Pump Rate 46 gpm: 110 - 220 ft

## **2.0 Methodology**

The following sections describe the geophysical probes used by Colog for this project and their general operating and physical principles.

### **2.1 EM Flowmeter**

EM flowmeter logging was performed with a Quantum Engineering Corporation Electromagnetic Borehole Flowmeter (EBF) and recording system. The probe features instantaneous response and equal sensitivity of positive or negative flows.

The EM flowmeter probe consists of an electromagnet and two electrodes located 180 degrees apart and 90 degrees to the magnetic field inside of a hollow cylinder. The flowmeter operates according to Faraday's Law of Induction, which states that the voltage induced by a conductor moving at right angles through a magnetic field is directly proportional to the velocity of the conductor through the field.

The fluid flowing through the recording section of the probe serves as the conductor, the electromagnet generates the magnetic field, and the electrodes measure the induced voltage. The electronics attached to the electrodes transmit a voltage directly proportional to the velocity of the water.

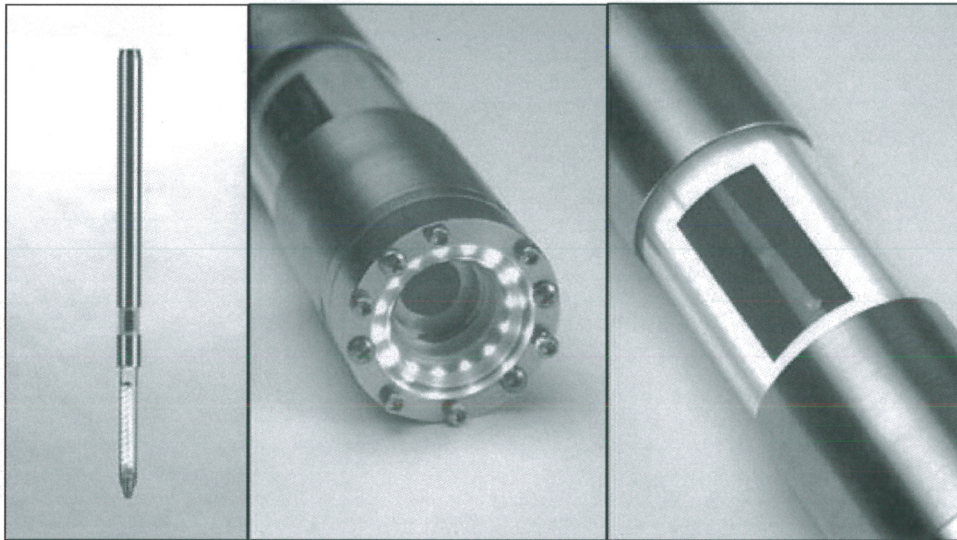
The probe is designed to measure flow rates of 0.010 to 10.0 gpm through the probe's 0.9" flow chamber. The flow rates equate to flow velocities of 0.30 and 300 fpm, respectively. The probe can be used in a 2" PVC casing with no diverter, 4 - 12" diameter wellbores with a diverter or used in larger diameter casings with out a diverter.

General logging procedure is as follows: Ambient flows (i.e. naturally occurring) are first recorded throughout the well at discrete depths. Then, while water is being pumped from near the top of the well at a constant rate, flow rates are again recorded at the same depths throughout the well for comparison.

## 2.2 Borehole Video Logging

COLOG provides borehole video utilizing either of two systems manufactured by CCV. These are complete stand-alone systems utilizing their own armored video coaxial cable, winches and control consoles. The high-resolution 1-5/8" black & white camera is suitable for wells from 2" to 6" ID. The 3" color camera will operate in wells from 4" to 24" ID, or greater depending on water clarity. Either a portable electric winch equipped with 500 feet of cable or a truck-mounted system with approximately 3,000 feet of cable is utilized for downhole logging operations. Video footage is recorded in real time to computer hard drive and electronically copied to DVD or other form of media for delivery to the client in the field.

For the Mountain Fuel Well, the 3" color camera and a truck-mounted logging system was utilized.



Images of 1<sup>5/8</sup>" diameter camera.

### **3.0 Limitations**

COLOG's logging was performed in accordance with generally accepted industry practices. COLOG has observed that degree of care and skill generally exercised by others under similar circumstances and conditions. Interpretations of logs or interpretations of test or other data, and any recommendation or hydrogeologic description based upon such interpretations, are opinions based upon inferences from measurements, empirical relationships and assumptions. These inferences and assumptions require engineering judgment, and therefore, are not scientific certainties. As such, other professional engineers or analysts may differ as to their interpretation. Accordingly, COLOG cannot and does not warrant the accuracy, correctness or completeness of any such interpretation, recommendation or hydrogeologic description.

All technical data, evaluations, analysis, reports, and other work products are instruments of COLOG's professional services intended for one-time use on this project. Any reuse of work product by Client for other than the purpose for which they were originally intended will be at Client's sole risk and without liability to COLOG. COLOG makes no warranties, either express or implied. Under no circumstances shall COLOG or its employees be liable for consequential damages.

**Attachment A:**

**Pump Specifications for the 30SQ/SQE10C-130 Submersible Pump**



# Grundfos SQ/SQE Data Book



ELECTRONICS

COMMUNICATIONS

P E R F O R M A N C E

GRUNDFOS



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# Features and Benefits

## SQ/SQE Submersible Pumps

SQ/SQE pumps are suitable for both continuous and intermittent operation for a variety of applications:

- Domestic water supply
- Small waterworks
- Irrigation
- Tank applications

### SQ, SQE pumps offer the following features:

- Dry-Run protection
- High efficiency pump and motor
- Excellent wear resistance, and sand handling capabilities
- Protection against up-thrust
- Soft-start
- Over-voltage and under-voltage protection
- Overload protection
- Over-temperature protection
- High starting torque

Additionally, the SQE pumps offer:

- Constant pressure control
- Variable speed
- Electronic control and communication

The SQ and SQE pump models incorporate a totally new motor design. With the use of permanent-magnet technology within the motor, the SQ/SQE pumps deliver unmatched performance. By combining permanent-magnet motors and Grundfos's own micro frequency converter, we are now able to control and communicate with the pump in ways never before possible. A few of the features that come out this combination are Constant Pressure Control, Soft-Start, and integrated Dry-Run protection. These are just a few of the many features that the SQ/SQE pumps can offer.

The SQ pump models are a simple pump that operates at a constant speed much like today's conventional pumps. The difference between it and today's pumps is you get all the benefits of an electronically controlled permanent-magnet motor that cannot be accomplished with a conventional induction motor. The SQ pumps are available for single phase power. They use a simple 2-wire design making installation easy.

The SQE uses the Grundfos "Smart Motor". Like the SQ model, we still use the high efficiency permanent magnet motor, but we give this motor the ability to communicate. The "Smart Motor" communicates via the CU300 status box through the power leads. It is not necessary to run any additional wires down the well. By being able to communicate with the pump you can have Constant Pressure Control and the ability to change the pump

performance while the pump is installed in the well. Like the SQ motor, this is also a 2-wire motor designed for single-phase operation.

The CU300 status box also allows you to communicate with the "Smart Motor" with the R100 infrared remote control. The R100 gives you the ability to monitor and setup your pumping system to meet the specific needs of your application. It is also important to note the "Smart Motor" can operate without the CU300, but you will lose some of the functions that are only possible by using the CU300.

The CU300 provides full control of the SQE pumps. If the pump stops, the CU300 will illuminate a light on the front panel. If you have an R100 you will be able to trouble shoot the system and recall the last five causes of failure.

## Pump and Motor Range

Product	Description	Material
SQ/SQE Pump	5,10,15,22,30 gpm	Stainless steel AISI 304
SQ-MS 3 Motor	Single-phase 1/3 - 1.5 Hp	Stainless steel AISI 304
SQE-MSE 3 Motor "Smart Motor"	Single-phase 1/3 - 1.5 Hp	Stainless steel AISI 304

## Pipe Connection

Pump Type	Threaded Connection
SQ/SQE 5	1" NPT
SQ/SQE 10,15	1 1/4" NPT
SQ/SQE 22, 30	1 1/2" NPT

## Type key

Example  
 Nominal flow GPM \_\_\_\_\_ 10  
 Type range \_\_\_\_\_ SQ  
 Electronic control/communication \_\_\_\_\_ E  
 Horsepower \_\_\_\_\_ 05  
 Motor designation \_\_\_\_\_ A  
 Head in ft at nominal flow rate \_\_\_\_\_ 160  
 Material specification \_\_\_\_\_ -NE

## Operating Conditions

Flow velocity past motor	Max. liquid temperature
0.0 f/s (Free convection)	86°F (30°C)
Min. 0.5 f/s	104°F (40°C)



## Features and Benefits

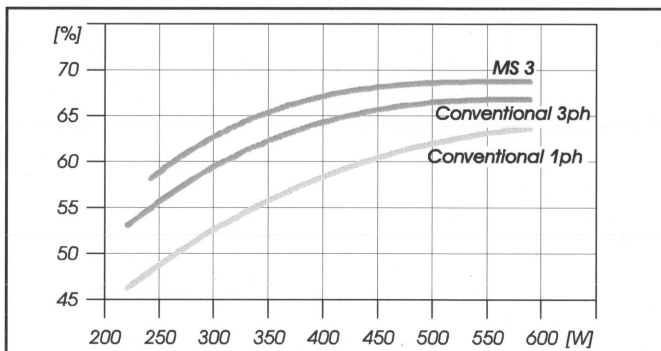
### Dry-Run Protection

The SQ and SQE incorporate integrated Dry-Run protection. When the water level falls below the inlet of the pump the pump will shut off. After a period of time, the pump will then automatically start up again.

For the SQ pumps the cut-off level is factory-set. For the SQE pumps you must set this level by using a CU300 and R100.

### High Motor Efficiency

The SQ and SQE motors are based on a permanent magnet rotor which produce high efficiency within a wide load range. The high and flat efficiency curve of the Permanent-Magnet motor allows for a coverage of a wide power range with the same motor, as compared to conventional AC motors. For SQE pumps, this means three motors to cover the horsepower range from 1/3 to 1.5Hp.

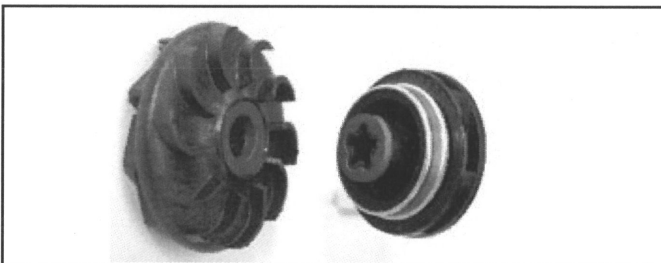


### High Pump Efficiency

The pump components are made from a 30% glass filled engineered composite. The pumps are designed to deliver at peak efficiency levels. Because of high pump efficiencies, overall power consumption will be reduced.

### Excellent Wear Resistance

The SQ/SQE pump design uses "floating" impellers. Each impeller has its own tungsten carbide/ceramic bearing. This design and the high quality materials make the pump very wear resistant especially in sandy conditions.

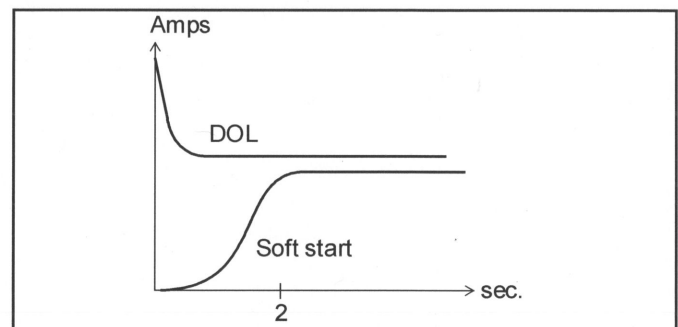


### Protection against up-thrust

During start-up many pumps start in an up-thrust condition. To prevent damage caused by up-thrust a top bearing has been placed in the motor to protect both the pump and the motor against up-thrust.

### Soft-Start

Both the SQ and SQE motors have a soft start because of the integrated electronics. Soft start reduces the starting current and gives the pump a smooth and steady acceleration.



The soft-start will reduce your chance of water hammer, minimizes the risk of wear and prevent overloading of your circuit during start-up.

### High Starting Torque

Because of the permanent-magnet motor the SQ/SQE pumps have excellent starting capabilities. The high locked rotor torque produced by the PM motor provides a starting torque that is 1.5 times greater than conventional pump motors. Even if the voltage is low the PM motor will still maintain a high starting torque.

### Overvoltage and Undervoltage Protection

Overvoltage and undervoltage may occur at anytime especially if you have an unstable voltage supply.

The integrated voltage protection of the SQ and SQE motors protects the motors when the voltage falls outside the permissible voltage range.

The 230V pump will cut out if voltage falls below 150V or above 280V. The motor will automatically start when the voltage is within the permissible voltage range. It is not necessary to have additional voltage protection.

### Overload Protection

When the pump load rises above the maximum amp level, the motor will automatically compensate and reduce the speed to maintain its maximum amp level. If the speed drops to 65% of the nominal speed, the motor will shut off.

# Features and Benefits

## Overtemperature Protection

Permanent-magnet motors emit very little heat because of their high efficiency. The SQ and SQE motors are designed with an internal circulation system to effectively cool all the internal motor components.

As extra protection, the electronic unit also has a built-in temperature sensor. When the temperature rises too high, the motor will shut off; when the temperature drops, the motor will automatically restart.

## Reliability

The SQ and SQE motors have been designed to withstand the toughest of applications and provide reliability. Some of those features are:

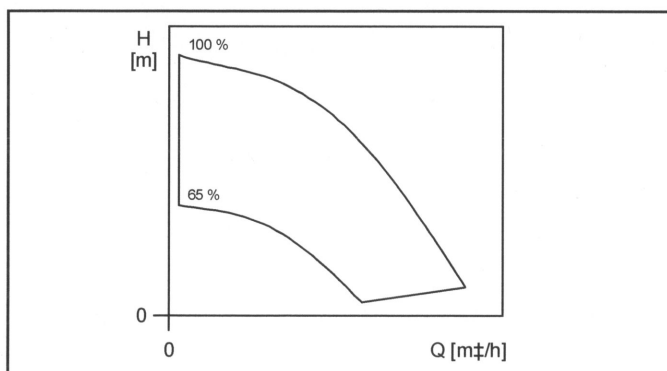
- Tungsten carbide/ceramic bearings
- Thrust bearings protecting against down-thrust
- Product lifetime equal or greater than conventional AC motors and 4" pumps

## Variable Speed

The SQE "Smart Motor" enables continuous variable speed control within 65% - 100% (7000-10700 rpm) of motor speed. The pump can be set to operate at any duty point in the range between 65% and 100% of the pump's performance curve. Your pump can then be adapted to any specific requirement. The variable speed control requires the CU300 control unit and the R100.

To help you decide on the proper speed, we have made available a speed calculation program called "SQE - Speed Calculation". This program is available as an option.

## Variable Speed Range of Operation



## Installation

The SQ and SQE may be installed vertically or horizontally.

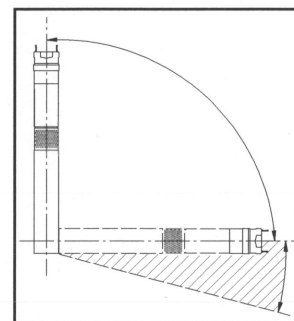
**Note:** The pump must not fall below the horizontal level in relation to the motor.

The following features ensure simple installation of the SQ and SQE pumps:

- Built-in spring loaded check-valve
- Light weight makes it easy to install
- Fits in 3" or larger wells

For horizontal installation, a flow sleeve is recommended in order to:

- Ensure sufficient flow past the motor to provide sufficient cooling
- Prevent the unit from being buried in sand or mud



## Service

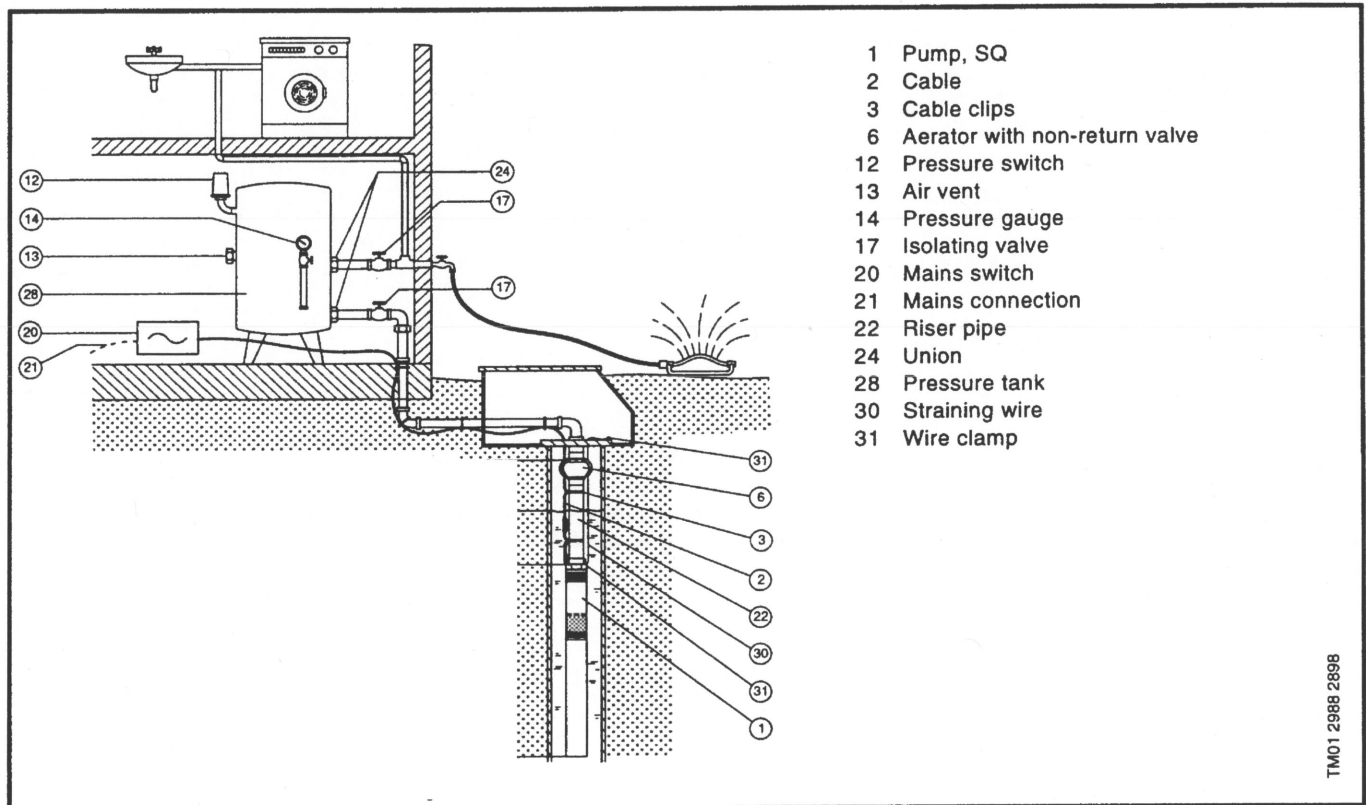
The modular design of the pump and motor makes it easy to repair and service. The motor lead is also replaceable.

## SQ with Pressure Switch and Diaphragm Tank

SQ is the perfect pump for domestic water supply. The SQ is easy to sell, install and operate.

### Replacement in Existing Installation

SQ and SQE pumps can be installed as replacement of a 4" submersible pump in an existing installation. By replacing an existing 4" pump with an SQ or SQE, you not only get the most advanced pump on the market, but you also have the ability to upgrade your system to a constant pressure system as shown on page 8.



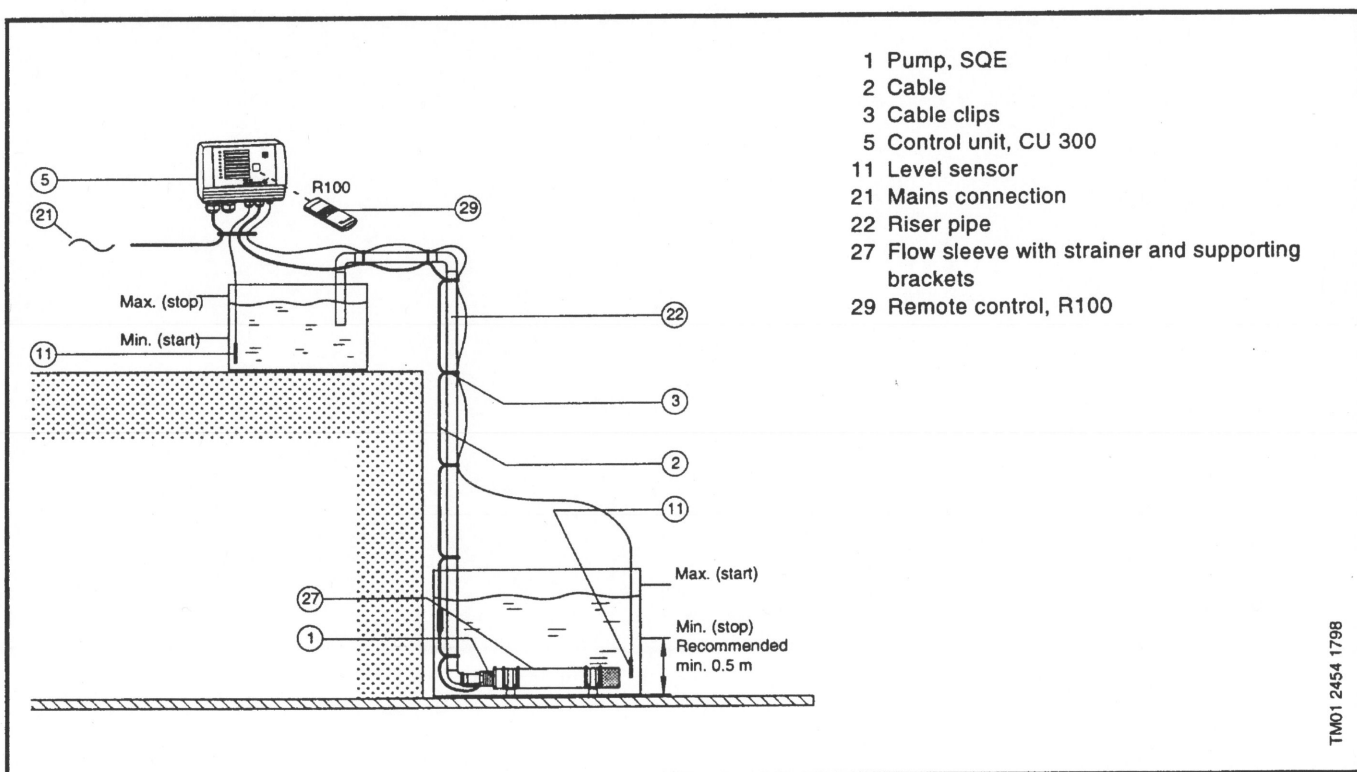
TM01 2988 2898





## Pumping from One Tank to Another

The SQE pump is ideal where there is a need to move water from one tank to another.



# Communication CU300

## CU300 Status Box

The CU300 status box is a control and communication unit especially developed for the SQE submersible pumps.

The CU300 status box provides:

- Easy adjustment to a specific well
- Full control of the SQE pumps
- Two-way communication with the SQE pumps
- Indicator lights on the front to indicate alarms
- The ability to start and stop the pump with the push of a button

The CU300 communicates with the pump using the power leads. It is not necessary to run any extra cables between the pump and the CU300 status box.

The following alarms can be indicated by the CU300:

- No contact
- Overvoltage
- Undervoltage
- Dry-Run
- Speed reduction
- Overtemperature
- Overload
- Sensor alarm

The CU300 incorporates:

- External signal input for three sensors
- Relay output for external alarm indication
- Control according to the signals received, e.g. flow pressure, water level and conductivity

The CU300 can communicate with the R100 infrared remote control.

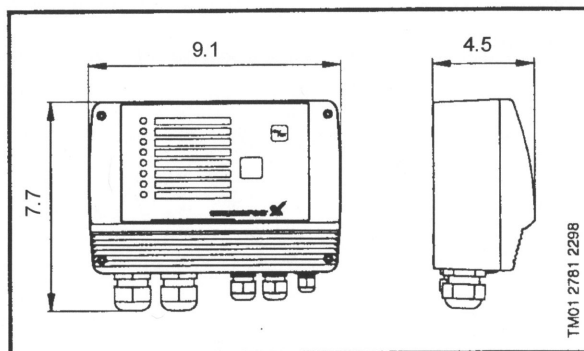
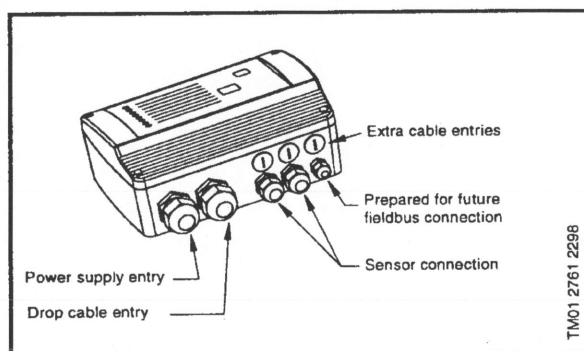
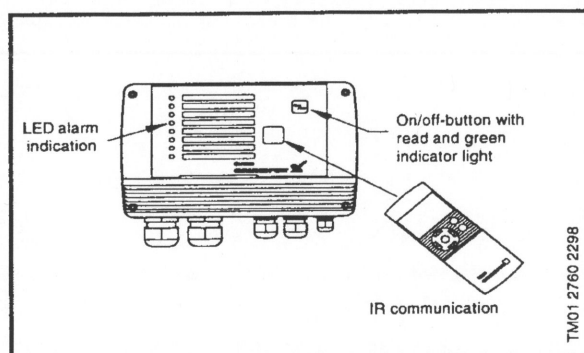
## R100 Remote control

The R100 allows you to monitor the installation by reading current operating parameters, such as:

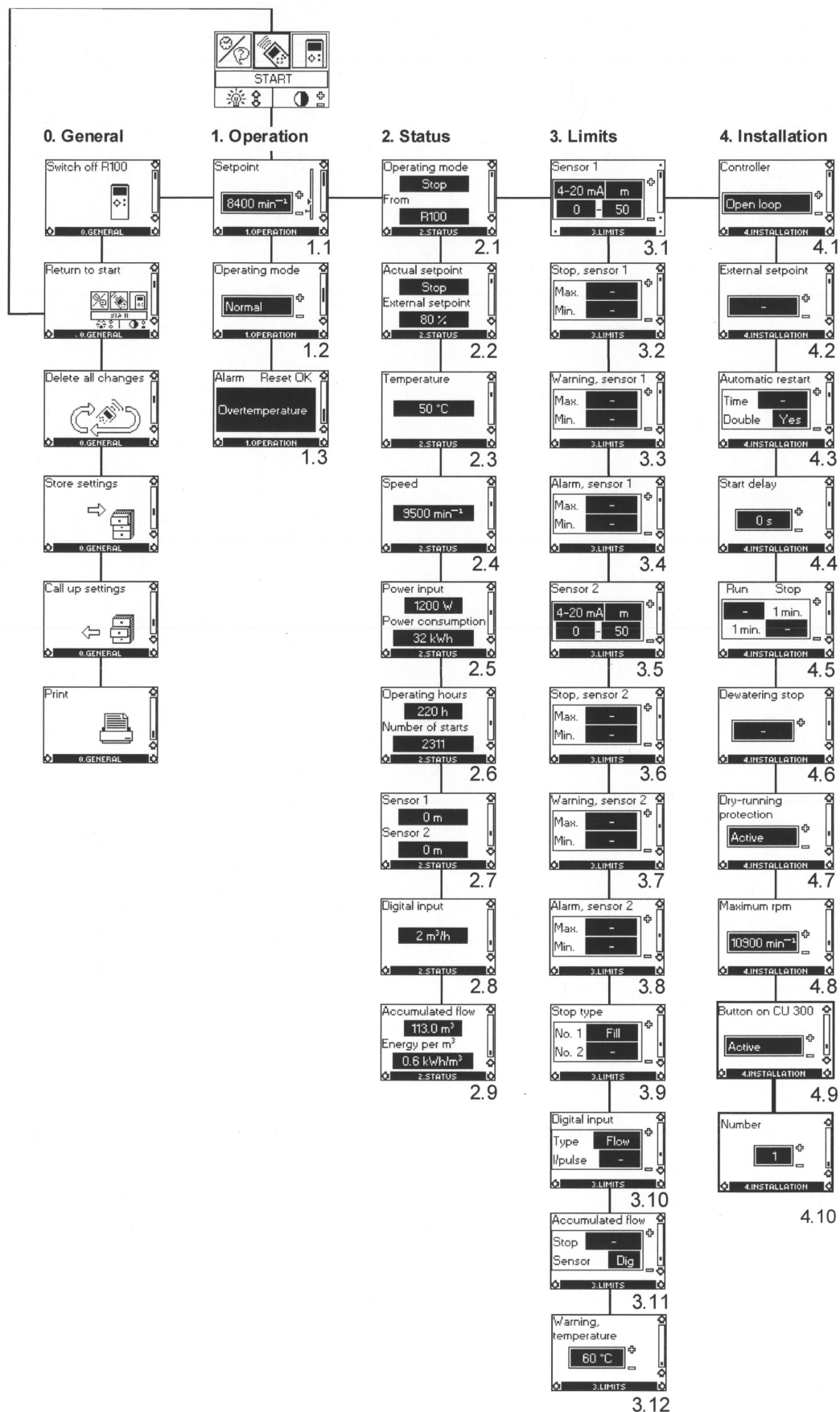
- Power consumption
- Energy consumption
- Number of operating hours

It allows you to change factory settings. A number of settings can be made, such as:

- Speed (performance)
- Constant pressure control mode
- De-watering function
- Automatic restart time



# R100 Menu Structure



# R100 Menu Structure

## R100 Menu Structure for the CU300

### 0. General

#### 1. Operation

- 1.1 Set-point setting
- 1.2 Selection of operating mode
- 1.3 Alarm indication

#### 2. Status

The indication of:

- 2.1 Actual operating mode
- 2.2 Actual and external set point
- 2.3 Actual motor temperature
- 2.4 Actual motor speed
- 2.5 Actual power input and accumulated motor power consumption
- 2.6 Accumulated number of operating hours and accumulated number of starts
- 2.7 Actual values of sensors 1 and 2 respectively
- 2.8 Actual values of the digital input
- 2.9 Accumulated flow, and the power used to pump 1 gal.

R100 allows you to make a number of settings:

#### 3. Limits

The setting of:

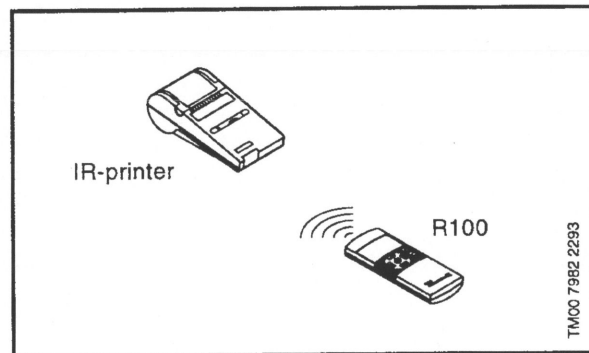
- 3.1 Sensor 1
- 3.2 Min. and max. stop limit of sensor 1
- 3.3 Min. and max. warning limit of sensor 1
- 3.4 Min. and max. alarm limit of sensor 1
- 3.5 Sensor 2
- 3.6 Min. and max. stop limit of sensor 2
- 3.7 Min. and max. warning limit of sensor 2
- 3.8 Min. and max. alarm limit of sensor 2
- 3.9 Filling or emptying
- 3.10 Setting of the function of the digital sensor connected to the digital input
- 3.11 The setting of the water quantity stop limit and the setting of the sensor to detect water quantity
- 3.12 The setting of the temperature warning limits of the motor electronics

#### 4. Installation

- 4.1 Selection of controller
- 4.2 Setting of external set-point
- 4.3 Setting of automatic restart time
- 4.4 Allocation of individual start delays
- 4.5 Setting of the stop and run times for the de-watering function.
- 4.6 Setting of the minimum value of the pump power input
- 4.7 Activating or deactivating the Dry-Run protection.
- 4.8 Setting of the maximum motor speed
- 4.9 Activating or deactivating the on/off-button on the CU 300.
- 4.10 Allocation of number where more than one CU 300 is installed.

#### Status report

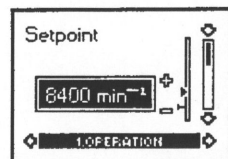
All settings and measured values can be transferred to a portable printer via wireless infrared communication and be printed in a status report.





## Examples of R100 displays

### Menu OPERATION



1.1

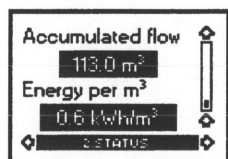
#### Set-point Setting

From the factory, the pump is set to maximum speed, 10,700 rpm. R100 allows you to reduce the pump speed by changing the setpoint. The speed can be set from 7,000 – 10,700 rpm, at 100 rpm intervals.

The unit of the set-point is automatically changed according to the unit of the sensor connection to sensor input no. 1.

EXAMPLE: Sensor input no. 1 is connected to a pressure sensor using the unit feet (ft.) and the range 0 – 200. Therefore, the set-point of display 1.1 can be set to between 0 – 200 ft.

### Menu STATUS



2.9

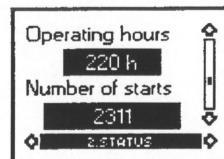
The displays appearing in this menu are status displays only. You cannot change settings in this menu.

#### Accumulated Flow

In display 2.9, the water quantity (gal.) pumped is shown. The value shown is the accumulated flow registered by the sensor selected in display 3.11.

The power used to pump 1 gal. is shown in the display as energy per gal. (kWh/gal.).

### Accumulated Number of Operating Hours and Number of Starts



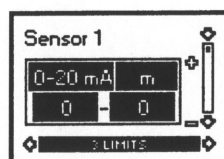
2.6

The value of operating hours and the number of starts are values accumulated from the time of installation and they cannot be reset.

Both values are stored in the motor electronics, and are kept even if the CU300 is replaced.

The number of operating hours is registered every two minutes of continuous operation.

### Menu LIMITS



3.1

#### The Setting of Sensor 1.

Depending on the type of sensor, the following settings can be made:

Sensor outputs:  
(not active), 0-10V, 2-10V, 0-20 mA, 4-20mA.

Setting range unit: M³/h, m, %, gpm, ft.



# **Grundfos SQ/SQE Performance Data**

## Easy Selection Chart

## 5SQ/SQE

**5 SQ/SQE**

## SELECTION CHARTS

(Ratings are in GALLONS PER MINUTE-GPM)

FLOW RANGE

(1.5 TO 8 GPM)

PUMP OUTLET

1" NPT

PUMP MODEL		HP	DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET																											
			PSI	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	400	460	520	600	700	800	900	1000	1100		
5SQ/SQE03A-90	1/3	0	8	7.5	6.7	5.7	4.4	2.6	0.4																					
		20	6.5	5.5	4.2	2.3	0.1																							
		30	5.1	3.6	1.6																									
		40	3.6	1.5																										
		50	1																											
		60																												
SHUT-OFF PSI:			97	89	78	71	20	11	2																					
5SQ/SQE03A-140	1/3	0	8	7.7	7.3	6.7	6.1	5.5	4.7	3.7	2.6	1																		
		20	7.1	6.6	6	5.3	4.5	3.5	2.2	0.6																				
		30	6.5	5.9	5.1	4.3	3.3	1.9																						
		40	5.8	5.1	4.1	3.2	1.8																							
		50	4.9	4	3	1.4																								
		60	3.8	2.6	1																									
SHUT-OFF PSI:			82	74	65	56	48	39	30	22	13	4																		
5SQ/SQE05A-180	1/2	0			7.9	7.5	7.1	6.7	6.2	5.6	5.1	4.4	3.6	2.6	1.1															
		20	7.8	7.4	7	6.5	6.1	5.5	4.9	4.2	3.3	2.3	0.8																	
		30	7.3	6.9	6.5	5.9	5.4	4.8	4.1	3.2	2	0.2																		
		40	6.9	6.5	5.9	5.4	4.7	4	3.1	2	0.1																			
		50	6.3	5.8	5.3	4.6	3.8	2.9	1.6																					
		60	5.7	5.1	4.4	3.6	2.6	1.2																						
SHUT-OFF PSI:			110	102	93	84	76	67	58	50	41	33	24	15	7															
5SQ/SQE05B-230	1/2	0			8	7.7	7.3	6.9	6.5	6.1	5.6	5.1	4.6	4.1	3.4	2.8	0.8													
		20		8	7.6	7.1	6.8	6.3	5.9	5.4	5	4.5	3.9	3.3	2.6	1.8	0.6													
		30	7.9	7.5	7.1	6.7	6.3	5.9	5.4	4.9	4.4	3.8	3.1	2.4	1.5															
		40	7.5	7.1	6.7	6.3	5.8	5.4	4.9	4.3	3.7	3.1	2.3	1.4																
		50	7	6.6	6.2	5.8	5.3	4.8	4.2	3.6	2.9	2.2	1.2																	
		60	6.5	6.1	5.6	5.1	4.6	4.1	3.4	2.8	2	0.9																		
SHUT-OFF PSI:			143	134	126	117	108	100	91	82	74	65	56	48	39	30	22	4												
5SQ/SQE05B-270	1/2	0				8	7.8	7.5	7.2	6.8	6.5	6.1	5.8	5.3	4.9	4.4	3.4	1.2												
		20			8	7.7	7.4	7.1	6.7	6.4	6	5.6	5.2	4.8	4.3	3.8	3.2	1.8												
		30		8	7.7	7.3	7	6.7	6.3	5.9	5.5	5.1	4.7	4.2	3.7	3.1	2.4	0.8												
		40	8	7.7	7.3	7	6.7	6.3	5.9	5.5	5.1	4.7	4.2	3.7	3.1	2.4	1.6													
		50	7.6	7.3	6.9	6.6	6.2	5.9	5.2	5	4.6	4.1	3.5	3	2.2	1.5	0.6													
		60	7.2	6.9	6.5	6.1	5.7	5.3	4.9	4.4	3.9	3.4	2.7	2.1	1.2	0.2														
SHUT-OFF PSI:			175	167	158	149	141	132	123	115	106	97	89	80	71	63	54	37	11											
5SQ/SQE07B-320	3/4	0					7.9	7.6	7.3	7	6.7	6.4	6.1	5.7	5.4	4.6	3.4	1.6												
		20				7.8	7.5	7.2	6.9	6.6	6.3	6	5.6	5.3	4.9	4.5	3.9	2.1												
		30			8	7.7	7.5	7.1	6.9	6.5	6.2	5.9	5.5	5.2	4.8	4.4	4	3.1	1.2											
		40		8	7.7	7.5	7.1	6.9	6.5	6.2	5.9	5.5	5.2	4.8	4.4	4	3.5	2.5	0.2											
		50	7.9	7.6	7.4	7.1	6.8	6.5	6.1	5.8	5.5	5.1	4.7	4.3	3.9	3.5	3	1.9												
		60	7.6	7.3	7	6.7	6.4	6	5.7	5.4	5	4.6	4.2	3.8	3.3	2.8	2.2	0.8												
SHUT-OFF PSI:			249	240	232	223	214	206	197	188	180	171	162	154	145	136	128	110	84	58										
5SQ/SQE10C-360	1	0						7.9	7.6	7.3	7.1	6.8	6.5	6.2	5.9	5.6	5.3	4.7	3.6	2.3										
		20						7.9	7.6	7.3	7	6.7	6.5	6.2	5.9	5.6	5.3	4.9	4.3	3.1	1.6									
		30				8	7.8	7.6	7.3	7	6.7	6.5	6.2	5.9	5.6	5.3	4.9	4.3	3.1	1.6										
		40			8	7.8	7.5	7.3	7	6.7	6.5	6.1	5.9	5.6	5.3	4.9	4.6	3.9	2.6	0.8										
		50		0.8	7.8	7.5	7.2	7	6.7	6.4	6.1	5.8	5.5	5.2	4.9	4.5	4.2	3.3	2											
		60	8	7.7	7.4	7.2	6.9	6.6	6.3	6	5.7	5.4	5.1	4.8	4.4	4.1	3.7	2.9	1.2											
SHUT-OFF PSI:			234	227	219	210	201	193	184	175	167	158	149	141	132	123	115	97	71	46	20									
5SQ/SQE10C-410	1	0							7.9	7.6	7.4	7.1	6.8	6.5	6	5.1	4.2	3.2	1.4											
		20							7.8	7.6	7.3	7	6.7	6.5	6.2	5.9	5.3	3.6	3.4	2.3										
		30					8	7.8	7.5	7.3	7	6.7	6.4	6.1	5.9	5.6	5	4.1	3	1.7										
		40				8	7.8	7.5	7.3	7	6.7	6.4	6.1	5.8	5.6	5.3	4.7	3.7	2.6	1.1										
		50			8	7.7	7.4	7.2	6.9	6.6	6.3	6.1	5.8	5.5	5.2	4.9	4.3	3.3	2.1											
		60			7.9	7.6	7.4	7.1	6.8	6.5	6.3	6	5.7	5.4	5.1	4.8	4.5	3.9	2.8	1.4										
SHUT-OFF PSI:					249	240	232	223	214	206	197	188	180	171	162	154	145	128	102	76	50	15								
5SQ/SQE10C-450	1	0								7.9	7.6	7.3	7	6.7	6.5	6	5.1	4.3	3.4	2										
		20								8	7.8	7.5	7.2	6.9	6.7	6.4	6.1	5.6	4.8	4	3.1	1.5								
		30							8	7.8	7.5	7.2	7	6.7	6.4	6.2	5.9	5.4	4.5	3.7	2.7	0.8								
		40						8	7.7	7.5	7.2	6.9	6.6	6.4	6.1	5.9	5.6	5	4.2	3.3	2.3									
		50					7.9	7.6	7.4	7.1	6.8	6.6	6.3	6	5.8	5.5	5.2	4.7	3.8	7.9	1.7									
		60					264	255	247	238	229	221	212	203	194	186	177	160	134	108	82	48								
SHUT-OFF PSI:					264	255	247	238	229	221	212	203	194	186	177	160	134	108	82	48										



## 10 SQ/SQE

## SELECTION CHARTS

FLOW RANGE

PUMP OUTLET

(Ratings are in GALLONS PER MINUTE-GPM)

(3 TO 15 GPM)

1 1/4" NPT

DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET																											
PUMP MODEL	HP	PSI	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	400	460	520	600	700	800	900	1000	1100
10SQ/SQE03A-110	1/3	0		14.8	13.5	12.5	11.0	9.0	6.0																		
		20	13.5	12.0	10.5	8.5	5.0																				
		30	11.8	10.0	8.0																						
		40	10.0	8.0																							
		50																									
		60																									
SHUT-OFF PSI:			56	48	35	30	17	13	4																		
10SQ/SQE05A-160	1/2	0			14.8	14.0	13.0	12.0	11.0	10.0	8.0	5.0															
		20	14.6	13.8	13.0	12.0	11.0	9.5	7.5	4.0																	
		30	13.5	12.8	11.8	10.5	9.0	7.0	2.0																		
		40	12.8	11.8	10.5	9.0	7.0	2.0																			
		50	11.5	10.2	8.5	6.0																					
		60	10.0	8.0	5.0																						
SHUT-OFF PSI:			84	76	67	58	50	41	32	24	15	6															
10SQ/SQE05B-200	1/2	0				14.8	14.0	13.5	12.8	12.0	11.0	10.0	9.0	7.0	5.0												
		20		14.5	14.0	13.3	12.5	11.8	10.8	9.8	8.5	6.5	4.0														
		30	14.5	13.8	11.8	12.5	11.5	10.5	9.5	8.0	6.0	3.0															
		40	13.8	13.0	12.5	11.5	10.5	9.5	8.0	6.0	3.0																
		50	13.0	12.0	11.5	10.5	9.0	7.5	5.5	1.5																	
		60	12.0	11.0	10.0	9.0	7.0	5.0																			
SHUT-OFF PSI:			113	104	95	87	78	69	61	52	43	35	26	17	7												
10SQ/SQE07B-240	3/4	0					14.6	14.0	13.5	13.0	12.4	11.5	11.0	10.0	9.0	8.0	6.5	2.5									
		20		15.0	14.5	14.0	13.5	12.8	12.2	11.5	10.8	9.8	8.8	7.8	6.4	4.5	2.0										
		30	15.0	14.3	13.8	13.3	12.8	12.0	11.3	10.5	9.5	8.5	7.5	6.0	4.0												
		40	14.5	13.8	13.3	12.8	12.0	11.3	10.5	9.5	8.5	7.5	6.0	4.0													
		50	13.8	13.0	12.5	11.8	11.0	10.3	7.5	8.3	7.0	5.5	3.5														
		60	13.0	12.4	11.7	11.0	10.0	9.0	8.0	6.7	5.0	2.5															
SHUT-OFF PSI:			143	134	126	117	108	100	91	82	74	65	56	48	39	30	22	4									
10SQ/SQE10C-290	1	0						14.7	14.3	13.8	13.3	12.8	12.3	11.8	11.0	10.5	9.5	7.7	3.0								
		20				15.0	14.5	14.2	13.7	13.2	12.8	12.3	11.5	10.8	10.5	9.5	8.5	7.5	4.5								
		30		15.0	14.5	14.0	13.7	13.2	12.7	12.0	11.5	10.8	10.0	9.3	8.3	7.2	5.8	1.5									
		40	15.0	14.5	14.0	13.7	13.2	12.5	12.0	11.5	10.8	10.0	9.3	8.3	7.3	5.8	4.0										
		50	15.0	14.5	14.0	13.0	12.5	12.0	11.2	10.5	9.8	9.0	8.0	7.0	5.5	3.5	1.0										
		60	13.8	13.3	12.8	12.3	11.8	11.0	10.5	9.6	8.8	7.7	6.5	5.0	3.0												
SHUT-OFF PSI:			173	165	156	147	139	130	121	113	104	95	87	78	69	61	52	35	7								
10SQ/SQE10C-330	1	0							14.7	14.4	14.0	13.5	13.0	12.7	12.2	11.6	11.0	9.8	7.2	3.0							
		20				15.0	14.7	14.3	13.8	13.5	13.0	12.5	12.0	11.5	10.8	10.3	9.5	8.0	4.5								
		30			15.0	14.5	14.2	13.8	13.3	12.8	12.5	11.8	11.3	10.8	10.2	9.5	8.8	6.8	2.2								
		40		15.0	14.6	14.2	13.8	13.4	12.8	12.4	12.0	11.4	10.8	10.2	9.5	8.7	7.8	5.5									
		50	14.8	14.5	14.0	13.7	13.2	12.7	12.2	11.7	11.2	10.5	10.0	9.3	8.5	7.5	6.6	3.5									
		60	14.4	14.0	13.5	13.0	12.6	12.2	11.5	11.0	10.5	9.7	9.0	8.2	7.3	6.1	4.8	1.2									
SHUT-OFF PSI:			203	195	186	177	169	160	152	143	134	126	117	108	100	91	82	65	39	13							
10SQ/SQE15C-380	1 1/2	0							15.0	14.7	14.3	14.0	13.7	13.3	12.8	12.5	12.0	11.0	9.3	7.0	3.5						
		20					15.0	14.6	14.3	13.8	13.5	13.3	12.8	12.3	12.0	11.5	11.0	9.8	7.8	4.7							
		30				15.0	14.5	14.3	13.8	13.5	13.3	12.8	12.3	11.8	11.3	10.8	10.3	9.0	6.5	3.0							
		40			14.8	14.5	14.3	13.8	13.5	13.0	12.7	12.3	11.8	11.3	10.8	10.3	9.8	8.3	5.5	1.0							
		50		14.8	14.5	14.1	13.7	13.3	13.0	12.5	12.2	11.7	11.2	10.7	10.2	9.5	8.8	7.2	4.0								
		60	14.7	14.4	14.0	13.7	13.3	13.0	12.5	12.0	11.5	11.0	10.5	10.0	9.4	8.7	8.0	6.0	2.0								
SHUT-OFF PSI:			234	225	216	208	199	191	182	173	165	156	147	138	130	121	113	95	69	43	30						

## 15 SQ/SQE

## SELECTION CHARTS

FLOW RANGE

PUMP OUTLET

(Ratings are in GALLONS PER MINUTE-GPM)

(4 TO 20 GPM)

1 1/4" NPT

DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET

PUMP MODEL	HP	PSI	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	400	460	520	600	700	800	900	1000	1100
15SQ/SQE03A-70	1/3	0		19.5	16.5	13	8.5																				
		20	15.5	12	7																						
		30	11	5																							
		40	5																								
		50																									
		60																									
SHUT-OFF PSI:			41	32	24	15	7																				
15SQ/SQE05A-110	1/2	0			19.5	17.5	16	13.5	11	7.5																	
		20	19	17.5	15.5	13	10.5	6.5																			
		30	17	14.5	12.5	9.5																					
		40	14.5	12.5	9.5																						
		50	11.5	8.5																							
		60	7.5																								
SHUT-OFF PSI:			65	56	48	39	30	22	13	4																	
15SQ/SQE05B-150	1/2	0				19	18	17	15.5	14	12	10	7														
		20		19	18	16.5	15	13.5	11.5	8.5	6																
		30	19	18	16.5	15	13	11	8.5	4.5																	
		40	17.5	16.5	15	13	11	8.5	4.5																		
		50	16.5	14.5	12.5	10.5	7.5	3																			
		60	14	12	10	7																					
SHUT-OFF PSI:			95	87	78	69	61	52	43	35	26	17	7														
15SQ/SQE07B-180	3/4	0					19.5	18.5	17.5	16.5	15.5	14	12.5	11	9	6.5											
		20		20	19	18	17	16.5	15	13.5	12.5	10.5	8.5	5.5													
		30	20	19	18	17	16	14.5	13.5	12	10	8															
		40	19	18	17	16	14.5	13.5	12	10	8																
		50	17.5	17	15.5	14.5	13	11.5	9.5	7																	
		60	16.5	15.5	14	12.5	11	9	6.5																		
SHUT-OFF PSI:			117	108	100	91	82	74	65	56	48	39	30	22	15	4											
15SQ/SQE10C-220	1	0						19.5	18.5	17.5	17	16	15	14	13	11.5	10	6									
		20			20	19	18.5	17.5	16.5	15.5	14.5	13.5	12.5	11	9.5	8	5.5										
		30		20	19	18.5	17.5	16.5	15.5	14.5	13.5	12.5	11	9.5	7.5	4											
		40	20	19	18.5	17.5	16.5	15.5	14.5	13.5	12.5	11	9.5	7.5	4												
		50	19	18	17	16	15	14	13	12	10.5	9	6.5														
		60	18	17	16	15	14	13	11.5	10	8.5	6															
SHUT-OFF PSI:			145	136	128	119	110	102	93	84	76	67	58	50	41	32	24	6									
15SQ/SQE10C-250	1	0							20	19.5	18	17.5	16.5	15.5	15	14	13	11	5.5								
		20				20	19.5	18.5	18	17	16.5	15.5	15	14	13	11.5	10.5	6.5									
		30			19.5	19	18.5	18	17	16	15.5	14.5	13.5	12.5	11.5	10.5	9	4									
		40		20	19	18.5	18	17	16.5	15.5	14.5	13.5	12.5	11.5	10.5	9	7										
		50	19.5	19	18.5	17.5	17	16	15	14.5	13.5	12.5	11	10	8.5	6.5											
		60	19	18	17.5	17	16	15	14	13	12	11	9.5	8	6												
SHUT-OFF PSI:			171	162	154	145	136	128	119	110	102	93	84	76	67	58	50	32	6								
15SQ/SQE15C-290	1 1/2	0							20	19.5	18.5	18	17.5	17	16.5	15.5	15	13.5	10.5	5.5							
		20					20	19	18.5	18	17.5	17	16	15.5	14.5	14	13	11	7								
		30				19.5	19	18.5	18	17.5	16.5	16	15.5	14.5	13.5	13	12	8.5									
		40			19.5	19	18.5	18	17.5	16.5	16	15.5	14.5	14	13	12	11	8.5									
		50	20	19.5	19	18.5	17.5	17	16.5	16	15	14.5	13.5	12.5	11.5	10.5	9.5	6									
		60	19.5	18.5	18	17.5	17	16.5	15.5	15	14	13.5	12.5	11.5	10.5	9	7.5										
SHUT-OFF PSI:			197	188	180	171	162	154	145	136	128	119	110	102	93	84	76	58	32	6							

## 22 SQ/SQE

### SELECTION CHARTS

(Ratings are in GALLONS PER MINUTE-GPM)

FLOW RANGE  
(7 TO 33 GPM)

PUMP OUTLET  
1 1/2" NPT

DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET

PUMP MODEL	HP	PSI	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	400	460	520	600	700	800	900	1000	1100
22SQ/SQE03A-40	1/3	0	31.5	23																							
		20																									
		30																									
		40																									
		50																									
		60																									
SHUT-OFF PSI:			17	7																							
22SQ/SQE05A-80	1/2	0		31.5	27.5	22.5	19.5																				
		20	26.5	21	11																						
		30	19.5	6.5																							
		40	6.5																								
		50																									
		60																									
SHUT-OFF PSI:			41	32	24	15	7																				
22SQ/SQE05B-120	1/2	0		33.0	31.0	28.5	25.5	22	17	7																	
		20	30.5	28	21	15	3																				
		30	27	24	20	13																					
		40	24	20	13																						
		50	18.5	10																							
		60	17																								
SHUT-OFF PSI:			65	56	48	39	30	22	13	4																	
22SQ/SQE07B-160	3/4	0			32	30.5	28.5	26.5	24	21	17.5	12	3														
		20	32	31.5	28	26	23.5	20.5	16.5	10.5																	
		30	29.5	27.5	25.5	22.5	19.5	15	8.5																		
		40	27.5	25.5	22.5	19.5	15.0	8.5																			
		50	24.5	22	18.5	14	6																				
		60	21	17.5	12	3																					
SHUT-OFF PSI:			89	80	71	63	54	45	37	28	19	11	2														
22SQ/SQE10C-190	1	0			33	31.5	30.5	29	27.5	25.5	23.5	21	18	14.5	8												
		20	32.5	31.5	30	28.5	27	25	23	20.5	17.5	13	4														
		30	31	29.5	28	26.5	24.5	22	20	16.5	12																
		40	29.5	28	26.5	24.5	22	20	16.5	12																	
		50	27.5	26	24	21.5	19	15.5	1																		
		60	25.5	23.5	21	18	14	8																			
SHUT-OFF PSI:			107	99	90	81	73	64	55	47	38	29	21	12	4												
22SQ/SQE15C-220	1 1/2	0				32.5	31.5	30	29	27.5	26	24.5	23	21	18.5	15.5	11.5										
		20		32.5	31	30	28.5	27.5	25.5	24	22.5	20.5	17.5	14.5	10												
		30	32	31	29.5	28.5	27	25.5	23.5	22	19.5	17	14	9													
		40	31	29.5	28.5	27	25.5	23.5	22.0	19.5	17	14	9														
		50	29.5	28	26.5	25.0	23.5	21.5	19.0	16.5	12.5	6.5															
		60	27.5	26.0	24.5	23.0	21.0	18.5	15.5	11.5																	
SHUT-OFF PSI:			130	121	113	104	95	87	78	69	61	52	43	35	26	17	9										

## 30 SQ/SQE

## SELECTION CHARTS

FLOW RANGE

PUMP OUTLET

(8 TO 42 GPM)

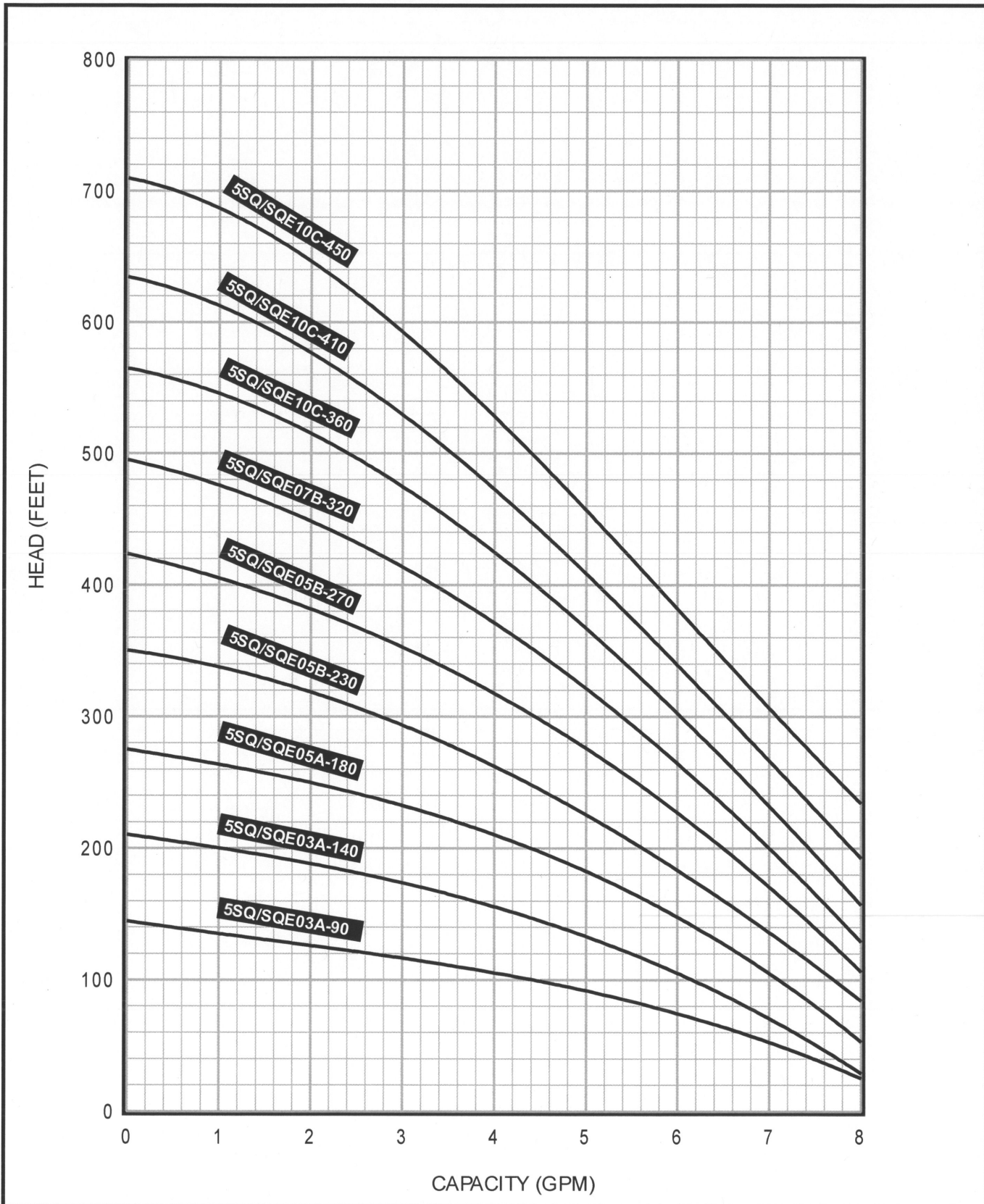
1 1/2" NPT

(Ratings are in GALLONS PER MINUTE-GPM)

DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET

DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET																											
PUMP MODEL	HP	PSI	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	400	460	520	600	700	800	900	1000	1100
30SQ/SQE05A-40	1/2	0	40.0	30.5	11.0																						
		20																									
		30																									
		40																									
		50																									
		60																									
SHUT-OFF PSI:			20	11	2																						
30SQ/SQE05B-90	1/2	0		41	36.5	31	23	9																			
		20	35.5	29	20	4																					
		30	27.5	17																							
		40	17																								
		50																									
		60																									
SHUT-OFF PSI:			48	39	30	22	13	4																			
30SQ/SQE10C-130	1	0			41.5	38.5	35.5	31.5	27.0	21.0	11.0																
		20	40.5	37.5	34.5	30.5	25.5	19.0	8.0																		
		30	37.0	33.5	29.5	24.0	17.0	4.0																			
		40	33.5	29.5	24.0	17.0	4.0																				
		50	28.5	22.5	14.0																						
		60	21.0	11.0																							
SHUT-OFF PSI:			76	67	58	50	41	32	24	15	7																
30SQ/SQE15C-170	1 1/2	0				41.5	39.5	37	35	32	28.5	24.5	19	11.5													
		20		41	39	36.5	34	31	27.5	23.5	17.5	9.5															
		30	40.5	38.5	36	33	30	26.5	22	16	6																
		40	38.5	36	33	30	26.5	22	16	6																	
		50	35.5	32.5	29.5	25.5	20.5	14	3																		
		60	32	28.5	24.5	19	11.5																				
SHUT-OFF PSI:			104	95	87	78	69	61	52	43	35	26	17	9													







## DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
5SQ/SQE03A-90	A	1/3 A	3"	1" NPT	30.4	19.8	10.6	2.6	2.9	12
5SQ/SQE03A-140	A	1/3 A	3"	1" NPT	30.4	19.8	10.6	2.6	2.9	12
5SQ/SQE05A-180	A	1/2 A	3"	1" NPT	31.5	19.8	11.6	2.6	2.9	12
5SQ/SQE05B-230	A	1/2 B	3"	1" NPT	33.6	19.8	13.7	2.6	2.9	13
5SQ/SQE05B-270	A	1/2 B	3"	1" NPT	33.6	19.8	13.7	2.6	2.9	13
5SQ/SQE07B-320	A	3/4 B	3"	1" NPT	34.6	19.8	14.8	2.6	2.9	13
5SQ/SQE10C-360	A	1 C	3"	1" NPT	38.2	21.3	16.9	2.6	2.9	16
5SQ/SQE10C-410	A	1 C	3"	1" NPT	38.2	21.3	16.9	2.6	2.9	16
5SQ/SQE10C-450	A	1 C	3"	1" NPT	39.3	21.3	18.0	2.6	2.9	16

NOTES: All models suitable for use in 3" wells, unless otherwise noted.  
Weights include pump end with motor in lbs.

## MATERIALS OF CONSTRUCTION

COMPONENT	SPLINED SHAFT
Valve Casing	Polyamide
Discharge Chamber	304 Stainless Steel
Valve Guide	Polyamide
Valve Spring	316LN Stainless Steel
Valve Cone	Polyamide
Valve Seat	NBR Rubber
O-ring	NBR Rubber
Lock ring	310 Stainless Steel
Top Bearing	NBR Rubber
Top Chamber	Polyamide
Guide Vanes	Polyamide
Impeller	Polyamide w/tungsten carbide bearings
Bottom Chamber	Polyamide
Neck Ring	Polyamide
Bearing	Ceramic
Suction Interconnector	Polyamide
Ring	304 Stainless Steel
Pump Sleeve	304 Stainless Steel
Cone for pressure equalization	Polyamide
Spacer	Polyamide
Sand Trap	316 Stainless Steel
Shaft w/coupling	304 Stainless Steel
Cable Guard	304 Stainless Steel

NOTES: Specifications subject to change without notice.

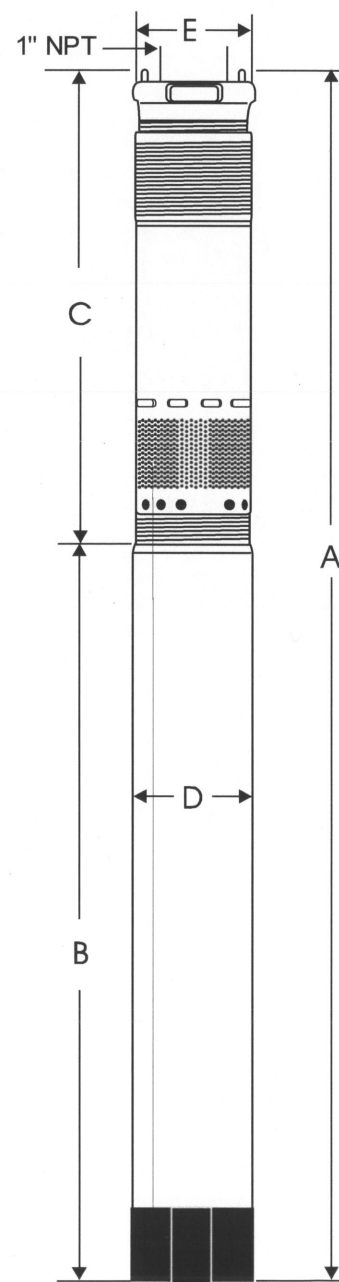
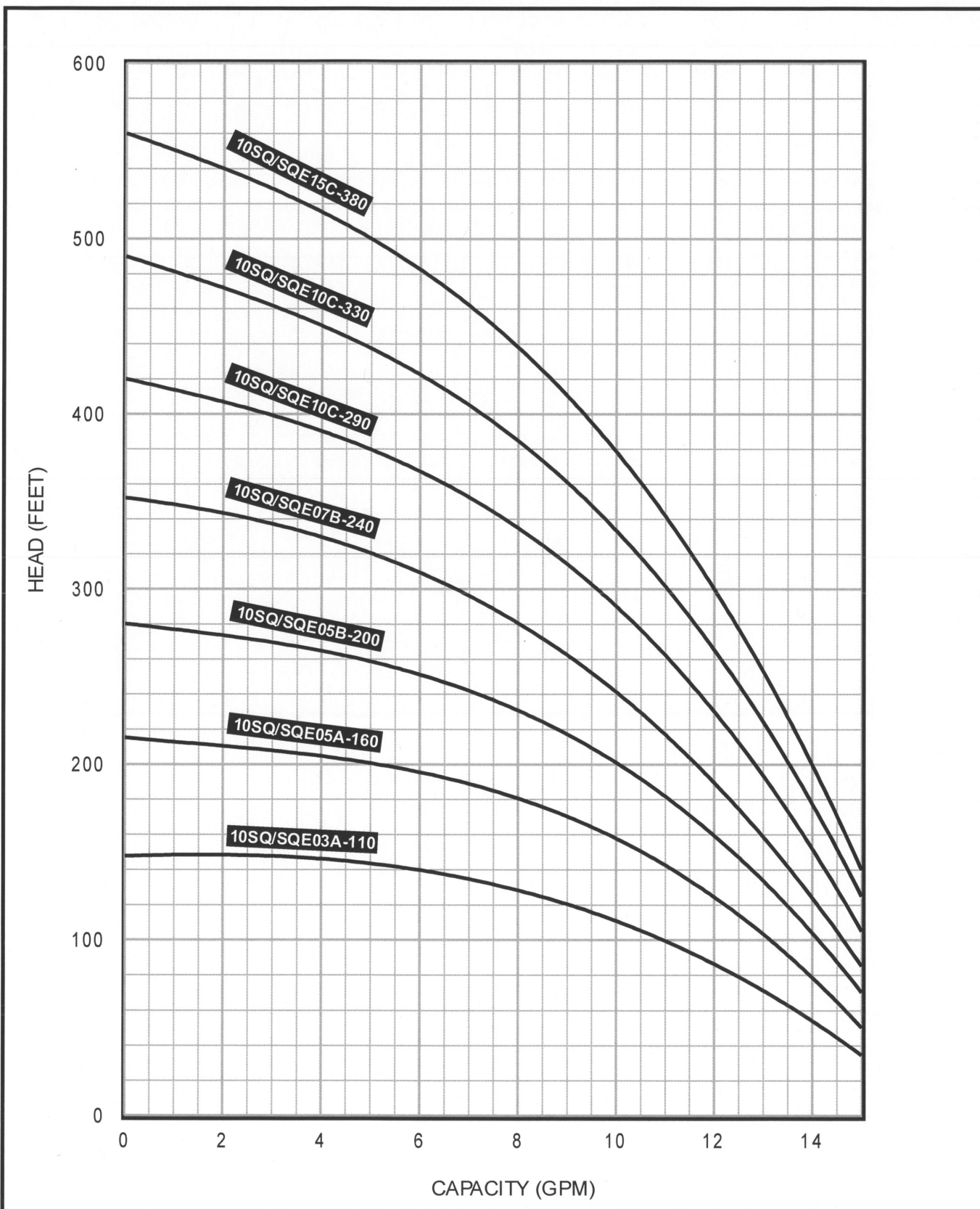


Fig. A

FLOW RANGE: 3 - 15 GPM

OUTLET SIZE: 1 1/4" NPT

NOMINAL DIA. 3"



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

PERFORMANCE CONFORMS TO ISO 2548 ANNEX B.

## DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
10SQ/SQE03A-110	A	1/3 A	3"	1 1/4" NPT	30.4	19.8	10.6	2.6	2.9	12
10SQ/SQE05A-160	A	1/2 A	3"	1 1/4" NPT	30.4	19.8	10.6	2.6	2.9	12
10SQ/SQE05B-200	A	1/2 B	3"	1 1/4" NPT	31.5	19.8	11.6	2.6	2.9	13
10SQ/SQE07B-240	A	3/4 B	3"	1 1/4" NPT	33.6	19.8	13.7	2.6	2.9	13
10SQ/SQE10C-290	A	1 C	3"	1 1/4" NPT	35.0	21.3	13.7	2.6	2.9	16
10SQ/SQE10C-330	A	1 C	3"	1 1/4" NPT	36.1	21.3	14.8	2.6	2.9	16
10SQ/SQE15C-380	A	1 1/2 C	3"	1 1/4" NPT	38.2	21.3	16.9	2.6	2.9	16

NOTES: All models suitable for use in 3" wells, unless otherwise noted.

Weights include pump end with motor in lbs.

## MATERIALS OF CONSTRUCTION

COMPONENT	SPLINED SHAFT
Valve Casing	Polyamide
Discharge Chamber	304 Stainless Steel
Valve Guide	Polyamide
Valve Spring	316LN Stainless Steel
Valve Cone	Polyamide
Valve Seat	NBR Rubber
O-ring	NBR Rubber
Lock ring	310 Stainless Steel
Top Bearing	NBR Rubber
Top Chamber	Polyamide
Guide Vanes	Polyamide
Impeller	Polyamide w/tungsten carbide bearings
Bottom Chamber	Polyamide
Neck Ring	Polyamide
Bearing	Ceramic
Suction Interconnector	Polyamide
Ring	304 Stainless Steel
Pump Sleeve	304 Stainless Steel
Cone for pressure equalization	Polyamide
Spacer	Polyamide
Sand Trap	316 Stainless Steel
Shaft w/coupling	304 Stainless Steel
Cable Guard	304 Stainless Steel

NOTES: Specifications subject to change without notice.

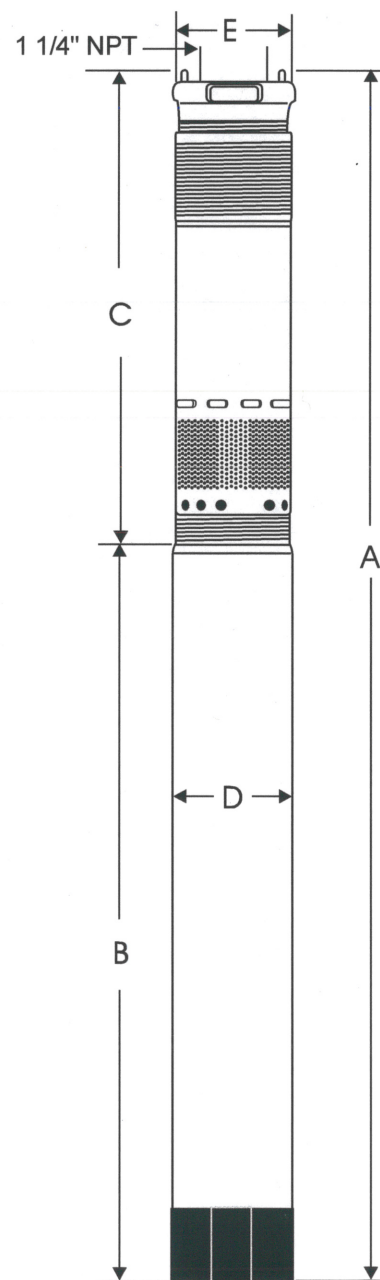


Fig. A

# Models 15 SQ/SQE

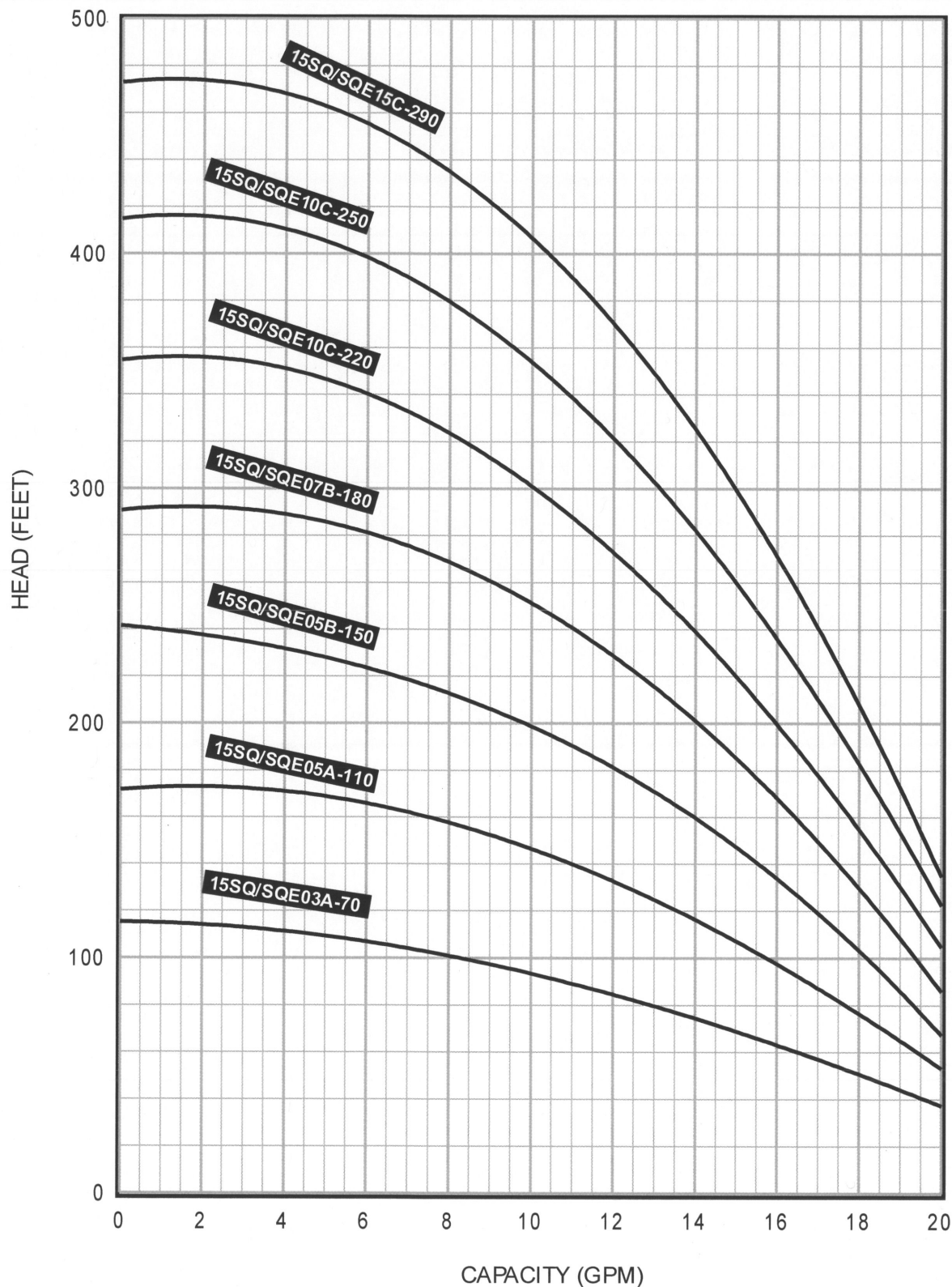
15 GPM

SQ/SQE Data

FLOW RANGE: 4 - 20 GPM

OUTLET SIZE: 1 1/4" NPT

NOMINAL DIA. 3"



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

PERFORMANCE CONFORMS TO ISO 2548 ANNEX B.



## DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
15SQ/SQE03A-70	A	1/3 A	3"	1 1/4" NPT	30.4	19.8	10.6	2.6	2.9	12
15SQ/SQE05A-110	A	1/2 A	3"	1 1/4" NPT	30.4	19.8	10.6	2.6	2.9	12
15SQ/SQE05B-150	A	1/2 B	3"	1 1/4" NPT	31.5	19.8	11.6	2.6	2.9	13
15SQ/SQE07B-180	A	3/4 B	3"	1 1/4" NPT	33.6	19.8	13.7	2.6	2.9	13
15SQ/SQE10C-220	A	1 C	3"	1 1/4" NPT	35.0	21.3	13.7	2.6	2.9	16
15SQ/SQE10C-250	A	1 C	3"	1 1/4" NPT	36.1	21.3	14.8	2.6	2.9	16
15SQ/SQE15C-290	A	1 1/2 C	3"	1 1/4" NPT	38.2	21.3	16.9	2.6	2.9	16

NOTES: All models suitable for use in 3" wells, unless otherwise noted.  
Weights include pump end with motor in lbs.

## MATERIALS OF CONSTRUCTION

COMPONENT	SPLINED SHAFT
Valve Casing	Polyamide
Discharge Chamber	304 Stainless Steel
Valve Guide	Polyamide
Valve Spring	316LN Stainless Steel
Valve Cone	Polyamide
Valve Seat	NBR Rubber
O-ring	NBR Rubber
Lock ring	310 Stainless Steel
Top Bearing	NBR Rubber
Top Chamber	Polyamide
Guide Vanes	Polyamide
Impeller	Polyamide w/tungsten carbide bearings
Bottom Chamber	Polyamide
Neck Ring	Polyamide
Bearing	Ceramic
Suction Interconnector	Polyamide
Ring	304 Stainless Steel
Pump Sleeve	304 Stainless Steel
Cone for pressure equalization	Polyamide
Spacer	Polyamide
Sand Trap	316 Stainless Steel
Shaft w/coupling	304 Stainless Steel
Cable Guard	304 Stainless Steel

NOTES: Specifications subject to change without notice.

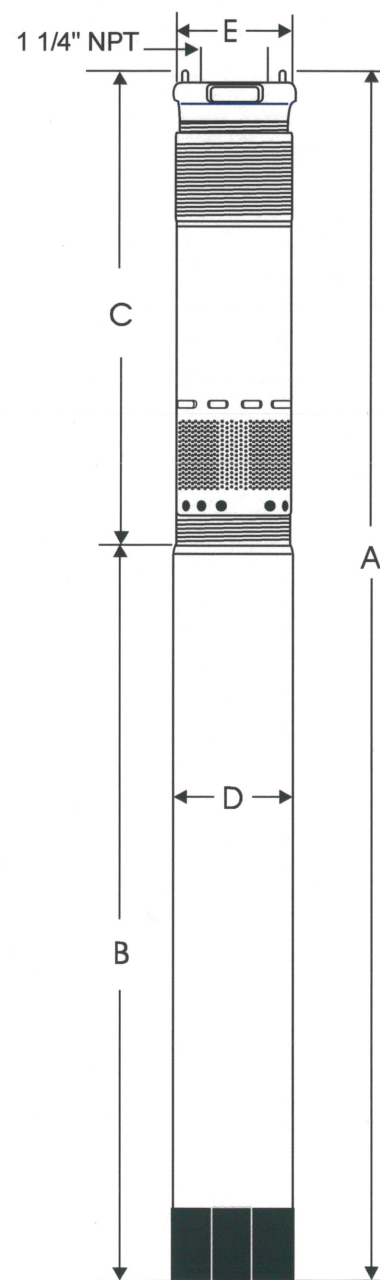


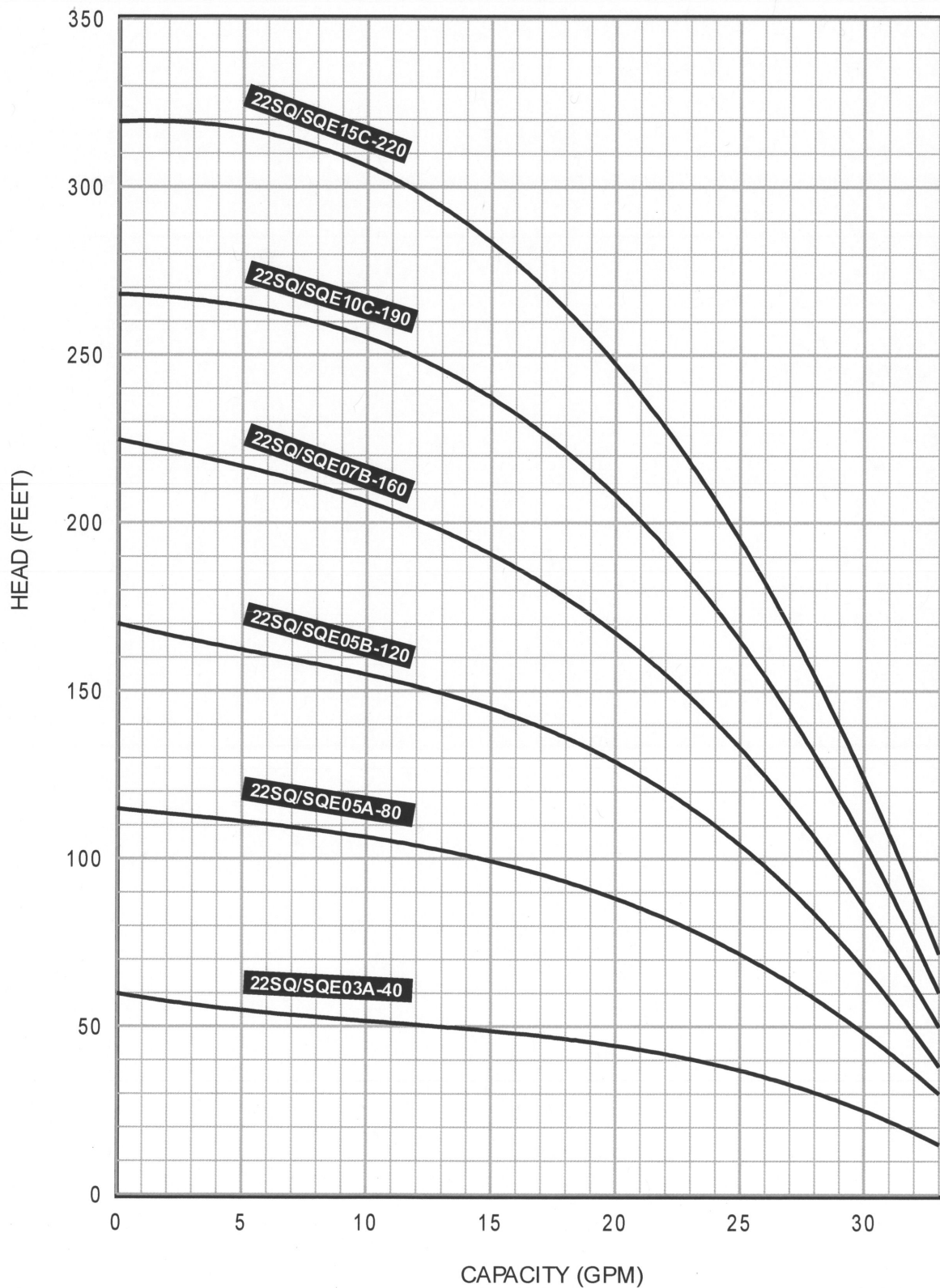
Fig. A



FLOW RANGE: 7 - 33 GPM

OUTLET SIZE: 1 1/2" NPT

NOMINAL DIA. 3"



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

PERFORMANCE CONFORMS TO ISO 2548 ANNEX B.

## DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
22SQ/SQE03A-40	A	1/3 A	3"	1 1/2" NPT	30.4	19.8	10.6	2.6	2.9	12
22SQ/SQE05A-80	A	1/2 A	3"	1 1/2" NPT	30.4	19.8	10.6	2.6	2.9	12
22SQ/SQE05B-120	A	1/2 B	3"	1 1/2" NPT	31.5	19.8	11.6	2.6	2.9	13
22SQ/SQE07B-160	A	3/4 B	3"	1 1/2" NPT	33.6	19.8	13.7	2.6	2.9	13
22SQ/SQE10C-190	A	1 C	3"	1 1/2" NPT	38.2	21.3	16.9	2.6	2.9	16
22SQ/SQE15C-220	A	1 1/2 C	3"	1 1/2" NPT	38.2	21.3	16.9	2.6	2.9	16

NOTES: All models suitable for use in 3" wells, unless otherwise noted.  
Weights include pump end with motor in lbs.

## MATERIALS OF CONSTRUCTION

COMPONENT	SPLINED SHAFT
Valve Casing	Polyamide
Discharge Chamber	304 Stainless Steel
Valve Guide	Polyamide
Valve Spring	316LN Stainless Steel
Valve Cone	Polyamide
Valve Seat	NBR Rubber
O-ring	NBR Rubber
Lock ring	310 Stainless Steel
Top Bearing	NBR Rubber
Top Chamber	Polyamide
Guide Vanes	Polyamide
Impeller	Polyamide w/tungsten carbide bearings
Bottom Chamber	Polyamide
Neck Ring	Polyamide
Bearing	Ceramic
Suction Interconnector	Polyamide
Ring	304 Stainless Steel
Pump Sleeve	304 Stainless Steel
Cone for pressure equalization	Polyamide
Spacer	Polyamide
Sand Trap	316 Stainless Steel
Shaft w/coupling	304 Stainless Steel
Cable Guard	304 Stainless Steel

NOTES: Specifications subject to change without notice.

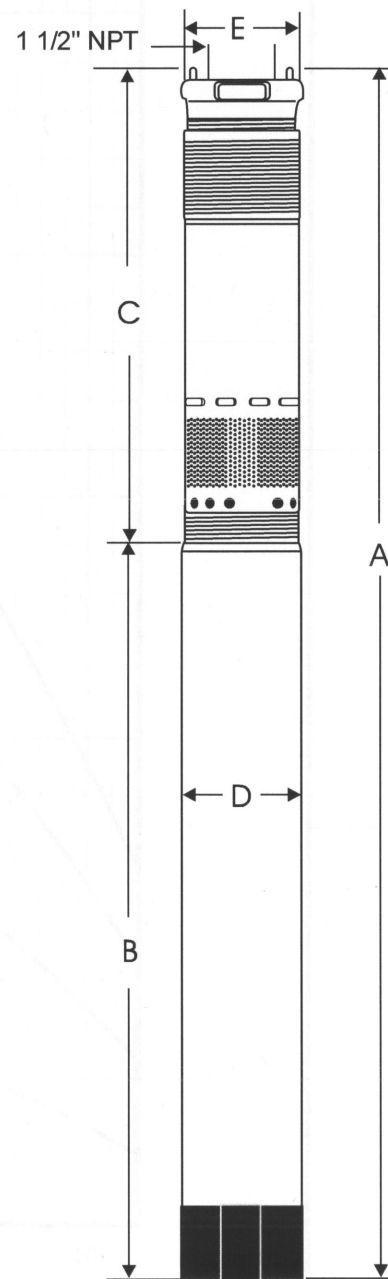


Fig. A

## DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
30SQ/SQE05A-40	A	1/2 A	3"	1 1/2" NPT	30.4	19.8	10.6	2.6	2.9	12
30SQ/SQE05B-90	A	1/2 B	3"	1 1/2" NPT	30.4	19.8	10.6	2.6	2.9	13
30SQ/SQE10C-130	A	1 C	3"	1 1/2" NPT	35.0	21.3	13.7	2.6	2.9	13
30SQ/SQE15C-170	A	1 1/2 C	3"	1 1/2" NPT	35.0	21.3	13.7	2.6	2.9	16

NOTES: All models suitable for use in 3" wells, unless otherwise noted.  
Weights include pump end with motor in lbs.

## MATERIALS OF CONSTRUCTION

COMPONENT	SPLINED SHAFT
Valve Casing	Polyamide
Discharge Chamber	304 Stainless Steel
Valve Guide	Polyamide
Valve Spring	316LN Stainless Steel
Valve Cone	Polyamide
Valve Seat	NBR Rubber
O-ring	NBR Rubber
Lock ring	310 Stainless Steel
Top Bearing	NBR Rubber
Top Chamber	Polyamide
Guide Vanes	Polyamide
Impeller	Polyamide w/tungsten carbide bearings
Bottom Chamber	Polyamide
Neck Ring	Polyamide
Bearing	Ceramic
Suction Interconnector	Polyamide
Ring	304 Stainless Steel
Pump Sleeve	304 Stainless Steel
Cone for pressure equalization	Polyamide
Spacer	Polyamide
Sand Trap	316 Stainless Steel
Shaft w/coupling	304 Stainless Steel
Cable Guard	304 Stainless Steel

NOTES: Specifications subject to change without notice.

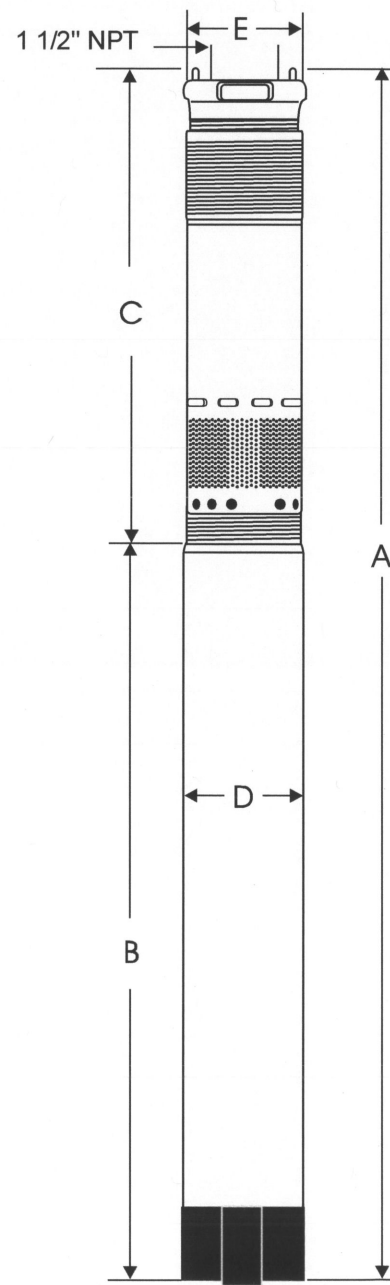


Fig. A

# **Grundfos SQ/SQE Technical Data & Accessories**

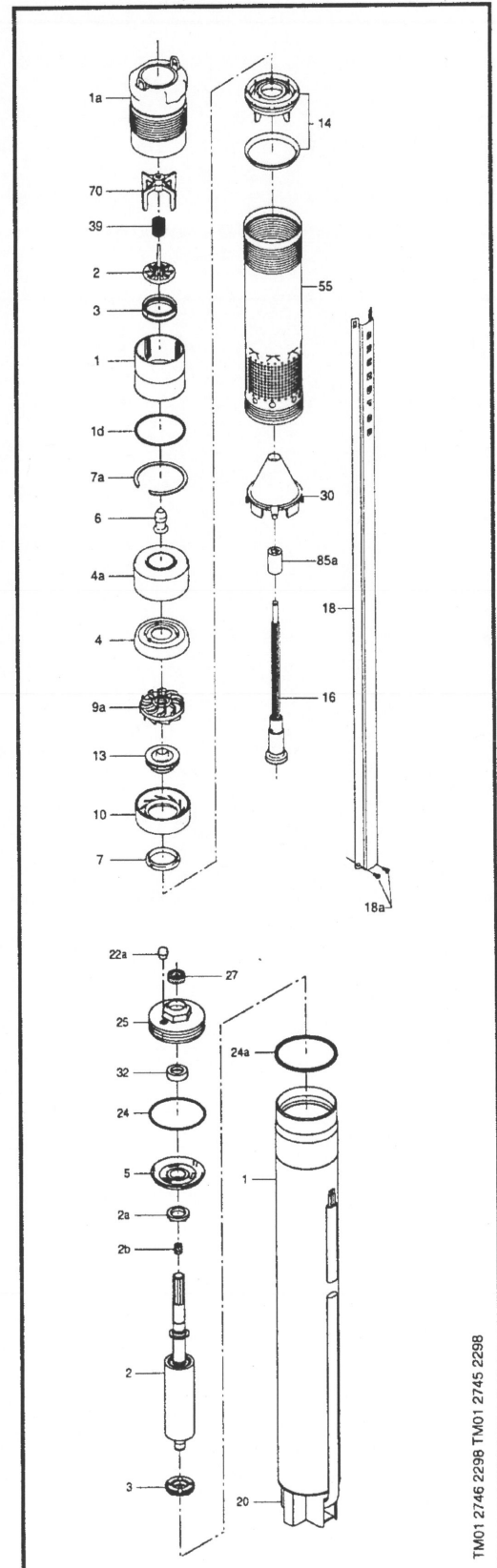
## Material specification (Pump)

Pos.	Component	Material	DIN W.-Nr.	AISI
1	Valve casing	Polyamide		
1a	Discharge chamber	Stainless steel	1.4301	304
1d	O-ring	NBR rubber		
2	Valve cone	Polyamide		
3	Valve seat	NBR rubber		
4	Top chamber	Polyamide		
4a	Empty chamber	Polyamide		
6	Top bearing	NBR rubber		
7	Neck ring	Polyamide		
7a	Lock ring	Stainless spring steel	1.4310	310
9a	Guide vanes	Polyamide		
10	Bottom chamber	Polyamide		
13	Impeller with tungsten carbide bearing	Polyamide		
14	Suction interconnector	Polyamide		
14a	Ring	Stainless steel	1.4301	304
16	Shaft with coupling	Stainless steel	1.4301	304
		Sintered steel		
18	Cable guard	Stainless steel	1.4301	304
18a	Screws for cable guard	Stainless steel	1.4401	316
30	Cone for pressure equalisation	Polyamide		
39	Valve spring	Stainless spring steel	1.4406	
55	Pump sleeve	Stainless steel	1.4301	304
70	Valve guide	Polyamide		
85a	Spacer	Polyamide		

## Material specification (Motor)

Pos.	Component	Material	DIN W.-Nr.	AISI
1	Stator	Stainless steel	1.4301	304
2	Rotor	Stainless steel	1.4301	304
2a	Stop ring	PP		
2b	Filter	Polyester		
3	Thrust bearing	Carbon		
5	Radial bearing	Ceramic/tungsten carbide		
20	Motor cable with plug	EPR		
22a	Filling plug	MS 3: NBR MSE 3: FPM		
24	O-ring	FPM		
24a	O-ring	FPM		
25	Top cover	PPS		
27	Filter	Polyester		
32	Shaft seal	MS 3: NBR MSE 3: FPM		
	Motor liquid	SML-2		

## Example: SQ



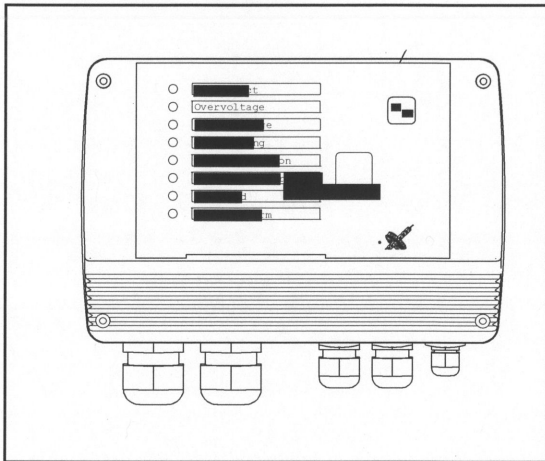
TM01 2746 2298 TM01 2745 2298



# SQ/SQE Technical Data

ELECTRIC	
Supply Voltage:	1x200-240V +6%/-10%, 50/60 Hz, PE 1x100-115V +6%/-10%, 50/60 Hz, PE
Operation via Generator:	As a minimum, the generator output must be equal to the motor P1[KW] +10%
Starting Current:	The motor starting current is equal to the highest value stated on the motor nameplate
Starting:	Soft-start
Run-up Time:	Maximum : 2 seconds
Motor Protection:	The motor is protected against: Dry running, overvoltage, undervoltage, overload, overtemperature
Power Factor:	PF= 1
Service Factor:	0.33-0.50A[Hp]-1.75 at 115V/230V 0.50-0.75A[Hp]-1.4 at 230V 1.0-1.5C[Hp]-1.15 at 230V
Motor Cable:	3 Wire, 14 AWG XLPE
Motor Liquid:	Type SML 2
pH Values:	SQ and SQE: 5 to 9
Liquid Temperature:	The temperature of the pumped liquid must not exceed 104°F.
Note: if liquids with a viscosity higher than that of water are to be pumped, please contact GRUNDFOS	
PIPING CONNECTION	
Discharge Port:	5SQ/SQE- 1"NPT 10-15SQ/SQE- 1 1/4" NPT 22-30SQ/SQE- 1 1/2" NPT
STORAGE CONDITIONS	
Minimum Ambient Temperature:	-4°F
Maximum Ambient Temperature:	+140°F
Frost Protection:	If the pump has to be stored after use, it must be stored on a frost-free location or it must be ensured that the motor liquid is frost-proof. The motor must be stored without being filled with motor liquid.
OPERATING CONDITIONS	
Minimum Ambient Fluid Temperature:	34°F
Maximum Ambient Fluid Temperature:	+104°F
APPROXIMATE DIMENSIONS AND WEIGHT	
Motor Dimensions (MS 3 & MSE 3): 0.33-0.50A[Hp] 0.50-0.75B[Hp] 1.0-1.5C[Hp]	20.9" length x 2.68" diameter 20.9" length x 2.68" diameter 22.3" length x 2.68" diameter
Motor Weights (MS 3 & MSE 3): 0.33-0.50A[Hp] 0.50-0.75B[Hp] 1.0-1.5C[Hp]	6.0 lbs 7.1 lbs 8.2 lbs
Pump End Dimensions: Pump Diameter: Pump Diameter, incl. cable guard:	2.68" 2.91"
Pump End Dimensions(min. and max.): 5SQ/SQE 10SQ/SQE 15SQ/SQE 22SQ/SQE 30SQ/SQE	10.6" to 18.0" 10.6" to 16.9" 10.6" to 16.9" 10.6" to 16.9" 10.6" to 13.7"
Pump End Weights (min. and max.): All SQ/SQE Models	2.2 lbs to 3.5 lbs
Well Diameter (minimum):	3"
Installation Depth (Maximum):	500 feet, below static water level

## CU300 Status Box



Description	Product no.
CU300 Status Box	96422776

## Constant Pressure Kit

Description	Product no.
5-15 SQE (Includes CU300, pressure transducer & .5 gpm flow switch)	96022968
22-30 SQE (Includes CU300, pressure transducer & 1 gpm flow switch)	96022971

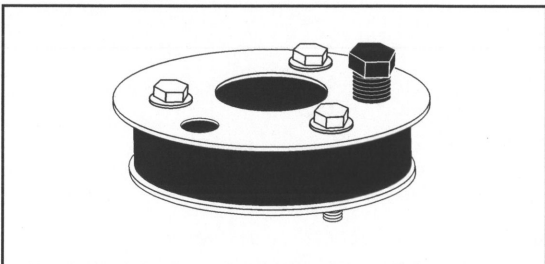
## Flow Switch

Description	Product no.
5-15 SQE .5 GPM	96022967
22-30 SQE 1 GPM	96022970

## Pressure Transducer

Description	Product no.
Pressure Transducer 0-90 psi (0-6 bar)	96026030

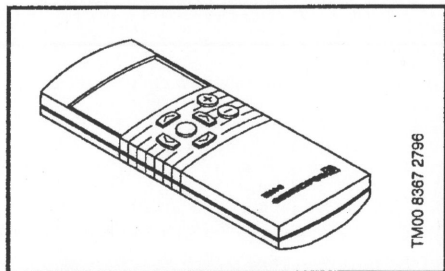
## 3" Well Seal



Description	Product no.
3" Sanitary Well Seal	1B5102

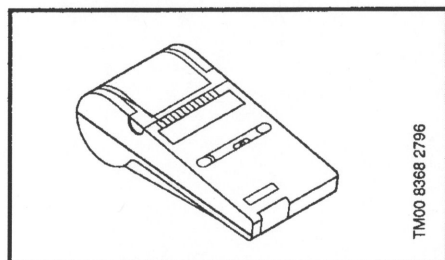
## SQ/SQE Accessories

### R100 remote control



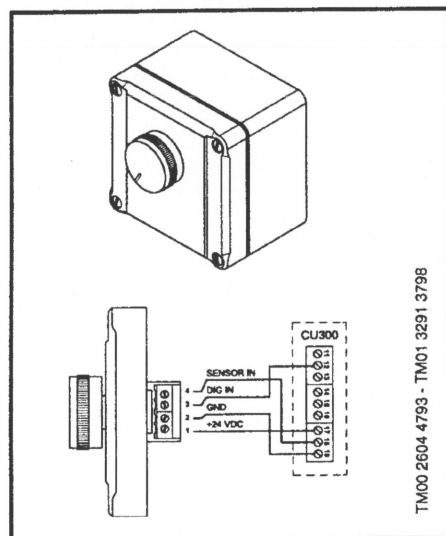
Description	Product no.
The R100 is used for wireless infrared communication with the CU300	6253333

### Printer



Description	Product no.
Printer for R100, infrared communication	620480
Type: Hewlett Packard, HP 82240B	
Paper Roll	620481

### Potentiometer

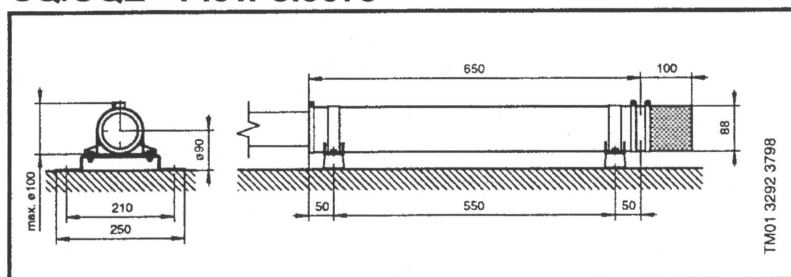


Description	Version	Product no.
External potentiometer with cabinet for wall mounting. Screened cables, 4-wire cable, max. length of cable: 100m	Grundfos potentiometer, SPP1 Enclosure class: IP 55	655468

### SQE - Speed calculation software

Description	Product no.
Speed calculation program (Windows95) including: • PC Tool SQE speed calculation, two diskettes • Operating manual	96426840

### SQ/SQE - Flow sleeve



Description	Product no.
Flow Sleeve Complete	96037505

## Notes

## Notes



## Notes

**GRUNDFOS®**



*Leaders in Pump Technology*

**Grundfos Pumps Corporation** • 3131 N. Business Park Avenue • Fresno, CA 93727

**Customer Service Centers:** Allentown, PA • Fresno, CA

**Phone:** (559) 292-8000 • **Fax:** (559) 291-1357

**Canada:** Oakville, Ontario • **Mexico:** Apodaca, N.L.

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